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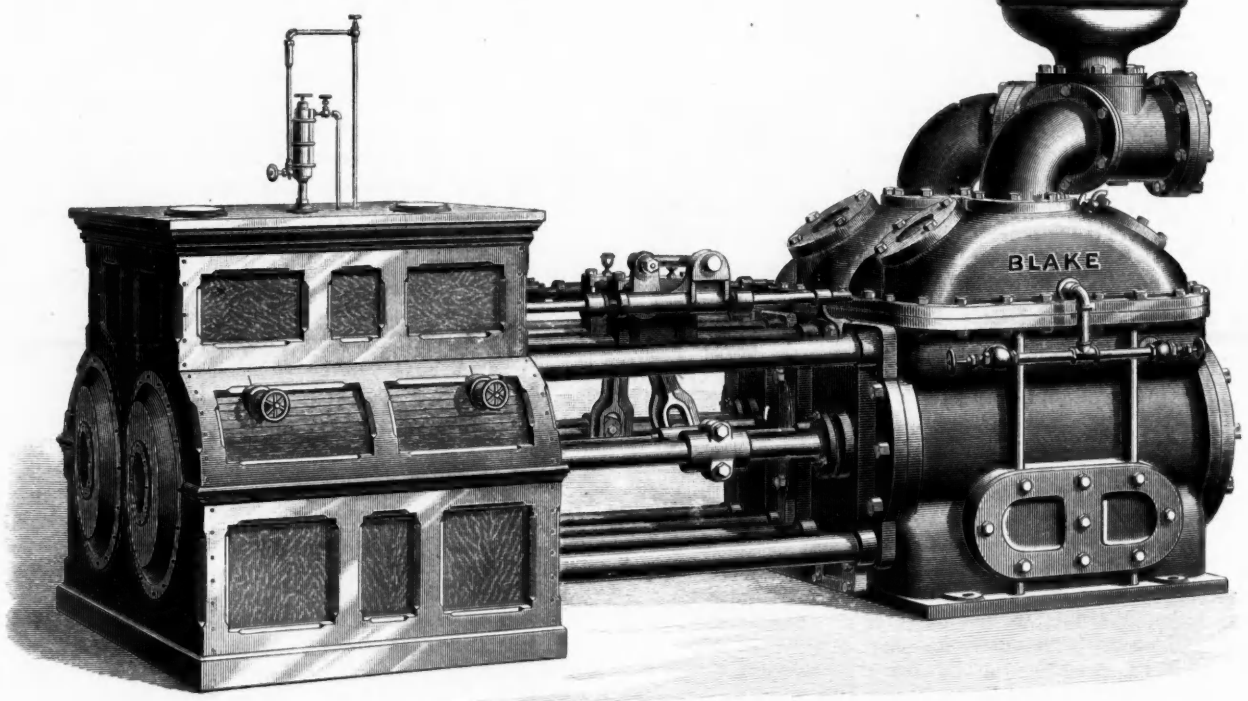
ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER

Blake's Duplex and Vacuum Pumps.

We present on this page engravings of two forms of steam pumps made by the George F. Blake Manufacturing Company, 95 and 97 Liberty street, New York.

The duplex pump here shown has steam cylinders 16″ diameter, with water plungers 10″ diameter and a stroke of 18″. The water plungers are packed with fibrous packing.

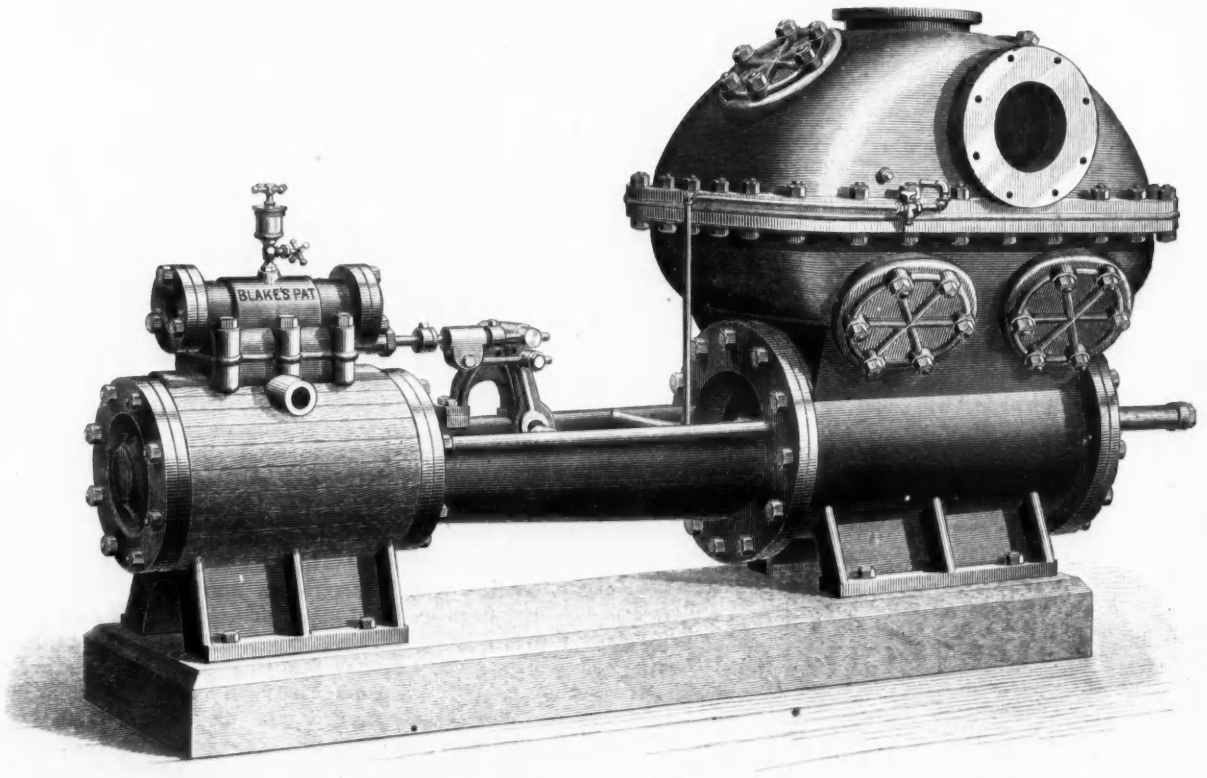
This pump has the improved adjustable lever-valve motion, recently added to their pumps by this company, and which can readily be adjusted to different conditions under which the pump may be working, so that the piston will make the full stroke under all circumstances. This, it is claimed, with the comparatively long stroke, reduces the loss from clearance in the steam cylinder to a minimum, and provides for steady, reliable working, materially increasing the economical use of steam over the form of valve motion formerly used.



BLAKE'S NEW DUPLEX PUMP.

The steam ends of the pumps are neatly encased, making them ornamental in appearance. Ample provision, however, is made for coming at the working parts for inspection or adjustment, should it be required. This is true, whether the pumps are made with simple or compound steam cylinders. The usual cushion adjustment for valves is provided. The thrust between the steam and water cylinders is taken by distance rods, which resist the strain in straight lines, so but trifling stability is required in the foundation.

The other engraving represents the direct acting vacuum pump, especially designed for producing a high vacuum in vacuum pans, which is accomplished by the peculiar arrangement of valves and passages. To provide against leak at the stuffing-box a partition is placed across the bed near the stuffing-box, and is kept filled with water, which covers the piston-rod and stuffing-box, thus entirely preventing air from being drawn in. This pump is also provided with the adjustable lever motion.



DIRECT ACTING VACUUM PUMP.

Extracts from Chordal's Letters.

PRINCIPLES OF SCREW CUTTING — USING JUDGMENT IN SETTING PLANER HEADS—WHAT DETERMINES WHETHER A MAN IS A MERE WORKMAN OR A MECHANIC—DIFFERENCE BETWEEN A PUBLIC DOG AND A PRIVATE DOG — CHORDAL'S PLAN FOR LATHE BOLTS—SOME HANDY LATHE TOOLS.

Mr. Editor:

* * * Stand twenty lathesmen up in a row, start catechising them, and you will only find two who understand the principles of a screw-cutting lathe. Any of the twenty can put gears on a lathe, and cut screws, if there is a brass plate around somewhere telling them what gears to put on. But only one out of ten can figure out the right gears in the absence of the table.

This looks like a big percentage of ignorance, but I will go still further, and say that not one out of ten really understands the subject, notwithstanding he can figure out the gears. I know lots of lathesmen who know how to figure change gears for lathes, and still have no conception of the principle involved. They know how to do it, and that is all. They have at some time learned one of the formulas. As the pitch of the lead-screw is to the pitch to be cut, so is one of the gears to the other gear. That is one of the pat formulas. Here is another: Count the threads in a certain number of inches of the lead-screw, and count the threads in the same number of inches of the screw to be cut, and you have the number of teeth in each of the gears to be used.

And again, the same thing differently expressed: multiply each of the pitches by one number, and you have the number of teeth in each of the gears.

The one lathesman out of ten knows one of these things, and probably figures it every day in the week. But if he gets the thread coarser than the lead-screw, he gets left About one in twenty understands the subject thoroughly, and is perfectly independent of any rule which may have been handed down to him. He is not bothered when he finds out that the stud runs only half as fast as the lathe arbor, and he can easily find out what gears to use to cut a thread of 1½″ pitch. The one in ten that I have referred to cannot figure out the gears for this pitch, or any other similar pitch.

There are two things involved in this screw-cutting problem. One is a knowledge of mathematics, as far as the Rule of Three, and another is ordinary commonplace reasoning power. I do not think a man ought to be called an intelligent machinist who cannot prove that he possesses both to the degree required in this screw-cutting operation.

* * * A lot of planer hands have been doing themselves great discredit lately by

their views in regard to the graduations of planer heads. The object of the graduations is to enable a man to swing a head a certain number of degrees. It is impossible to graduate a planer in degrees, or to figure it in such manner that it will not give this information, and this is certainly all the information which the planer ought to give.

A drawing of angular work showing the number of degrees between the angular surfaces and the planer graduations, enables you to get the proper angle. An ordinary dovetail job for a lathe rest, for instance, has its angular surfaces located sixty degrees from each other. The draughtsman who understands his business, marks from one of the surfaces to the other "60 degrees." Such a job on a planer requires one kind of a setting of the head, if it lays horizontally when planed, and an entirely different setting if set vertically when planed. It makes all the difference in the world whether you bolt the job to the planer table or whether you bolt it up against an angle plate. The graduations on a planer head can no more furnish the judgment for the planer hand, and should be no more expected to do so, than they should be expected to furnish the bolts and clamps for the job, or guarantee the operation of the down feed.

This graduation question is similar to the screw-cutting matter. Lots of planer men don't know anything about these graduations, except that they are a lot of marks on one side of the planer swing. They don't know what a degree is. They never imagined that this little lot of graduations bore any relation to a complete circle, and never knew that all degrees are the same. If some of these fellows could have a little more night school among themselves during the noon hour, they could make themselves feel a great deal wiser in a very short time.

* * * This whole business reminds me of Jay Smith, who I suppose has been working at the machine trade for some thirty years. He designates taps and dies and threads as No. 10, No. 12, No. 14, &c., and he can take a rule and measure a thread and tell you whether it is No. 10, No. 12, or No. 14 exactly, every time. And right there his mental conception of this whole question of pitches ends. His master mind is charged with the belief that a certain thread is a No. 10 thread, and that, as good luck will have it, you can recognize this number every time by finding eleven threads in an inch. The use of the word "pitch," for "distance from thread to thread," is without any meaning at all to him. In short, he don't know anything at all about the matter.

You may be astonished to know it, Mr. Editor, but the honest fact is that three machinists out of ten are as ignorant on this point as Mr. Jay Smith. It seems hardly possible to believe some of these things.

* * * When you find a man of this No. 10 tap style, you would be sure to find a man whose knowledge of his trade is made up entirely of things which have been picked up in their entirety; nothing evolved from his mind by any principle of thought or reason. Just such little things as these determine whether a man is a mere workman or a mechanic.

* * * The traveling lathesman will sometimes strike a shop where they give him a lathe with a face plate, and a chuck, and a pair of centers, and a lot of change gears, and a steady rest, and a follower rest, and maybe something to hold water. And then they say to him: 'There is the tool-room over there; you will find bolts and clamps and tools." And the foreman says, "I will bring the work you are to do." Such shops are rare. Such a lathesman has to work with the tools which the shop dictates. He must take the dogs as he finds them. Ditto bolts, and ditto everything else. Very few original ideas does he get a chance to introduce into his work. It is in such a shop that the dumb-headed workman is put to his greatest use.

In another shop our lathesman is given a lathe with the same accessories. But there is no tool-room. His tools he must figure out himself. The bolts he must skirmish for. The dogs he must pick up where he can. Here is where the smart fellow will get in his best licks.

In the matter of tools little need be said. But there are other things about a lathe about which little ever is said. First, in the matter of dogs. No lathesman in such a shop ever has control of dogs, and he has to take his chances with the rest of the lathes, on about half a set probably. But you will find in the course of time that the sharp fellow will accumulate a convenient set of dogs of small size, which he locks up and calls his own. The shop stands the cost of them, of course, and it can well afford to donate them to the man who gets them up.

There is an astonishing difference between a public dog and a private dog. The private dog has a nice steel set screw. It is really hard at the point, and pretty hard throughout its length, and it fits the hole, and the dog has been filed out a little bit V'ing in the bottom and square across. The set screw can be screwed down till it pinches, and requires a wrench only for a firm setting. The dog's tail will reach from the job into the face plate of that particular lathe, and if it gets bent it straightway gets straightened.

The public dog is the meanest kind of a dog. As no one has an interest in this dog no one ever takes the trouble to file it square across in the hole, and the hundred and odd chaps who broke the set-screw have put in a hundred and odd iron set-screws, and steel set-screws, and brass set-screws, and set-screws with the wrong thread, and set-screws too long, and set-screws too short, and set-screws worn out and bent, and set-screws that won't screw clear down, and that upset so at the point that they won't unscrew clear up. The man with a memory knows that a 2" dog with an upset set-screw can only be got on a 1½" job and can't be screwed down on a 1¼" job.

And lo! the tail of the public dog, if it has a tail. It has notches filed in it so as to reach the slots of a little lathe, and it has been banged over so as to reach the slots in a big lathe, and it has got twisted round so that it won't stay in the slots of any lathe, and it is broken off and gone anyhow, and the driving is done by the set-screw.

* * * Next to the dogs come the bolts. Who has not fussed with public lathe bolts? May the Lord deliver me from ever having anything to do with a set of lathe bolts which I can't call my own. No man hesitates to take a nut from the public lathe bolt to use as a driver on a mandrel, or to use as a washer on a smaller bolt, and ten chances to one the nuts are not put back when the use of the bolts is over, and there are no two of the same length to be used in pairs, and the heads will go through the slots in some face-plates, and the bodies will not drive into the slots in other face-plates.

* * * Let me mention my own plan of lathe bolts, many a set of which I have made and had rows over. Cut off round iron the right length, running from 3" to 12" by variation of 1". A nut is put on each end. There are two of each length. Such a set of bolts will fulfill every condition, and the double-ended feature is of immense advantage. If a bolt when drawn up proves a little too long, and wants to strike a head-stock, the bolt can be shortened by moving the outer nut up somewhat. I never left washers on bolts, but always took them off and kept them strung on a rod screwed into the head-stock of the lathe.

* * * Another little trick about a lathe: If there is a gear to be bolted to the face-plate, this is the commonest process: You get your blocks, pile them on the lathe and stand the gear up against the face-plate, and get a flat drill and set the tail-stock where you think it ought to be. Then get a chunk of square iron with a center in it to go across the cored hole in the gear. Then call Bill, or Tom, or Hank, or whoever calls on you oftenest, and one of you holds the blocks and the other sets the gear up against the blocks as central as possible. Then the block-man lets go and grabs the square chunk of iron and the flat drill, and puts them in place and screws up the dead center, and yells "All right," and the gear-man lets go, and the whole business falls to pieces. You forgot to tighten the tail-stock.

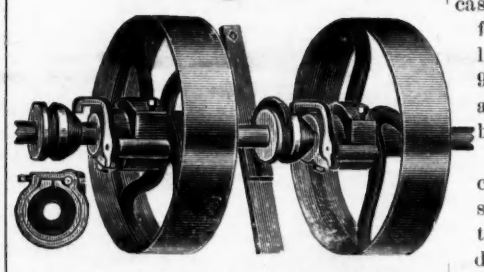
You tighten it and do the whole job over again, and do it right, and your kind friend goes off about his business, and you grab a lump of chalk and start the lathe going. You get a chalk mark on the wheel and hit it a lick with a hammer; your square piece of iron tips a little on you, and the whole thing falls down again. You call your friend again, and set the establishment up for the third time. Your friend is mad and you are getting nervous, and you find that the little center in the small block is too small for the point of the drill, and that the little center in the back end of the drill is too small for the lathe center. So, of course, this last setting consumes considerable time.

I know of a little tool that will avoid considerable of this trouble, though I will not say the biggest part of it. The tool I refer to is a happy combination of the flat drill and the square bar, and it is made as follows: Take a piece of ¾" round iron 16" long, and have the blacksmith upset one end and spread it out into the shape of a nice drill, say 4½" across. In the other end of this bar countersink a center the full diameter of the bar; turn this thing up, put a nice finish on it and call it a valuable tool. You will find it a good friend. Drill a hole through the flat part so that it will hang on a nail.

* * * Another handy lathe-tool: a nice, thin, flat little steel shovel which will just fit between the V's on top of your lathe bed. Keep the edge nice and keen and straight. One trip along your lathe shears will take out the chips and dirt and grease.

* * * Another good lathe tool: a monkey wrench which you can call your own, paid for with your own money and kept in good shape, and put in the same place every time. It beats all the shop monkey-wrenches ever made. * * *

Very respectfully,
CHORDAL.



Carver's Improved Friction Clutch.

The accompanying engraving represents a friction clutch made by McMahon & Carver, Worcester, Mass. It is intended for use in driving lathes, planers, and other machines and tools. The pulley at the right of the engraving is shown with this friction device attached to the hub with, a lever or shipper in position for operating it. This view shows the clutch in gear, while the pulley at the left represents the clutch as it appears when thrown out of gear. The small engraving at the left is a sectional view through the hub of pulley and friction device. The center represents the shaft surrounded by the hub of the pulley, which revolves continuously, being driven by a belt. A band with two lugs, and open at one side, is fitted to the hub of the pulley, so that when there is no pressure upon the lugs the hub of the pulley is left free to rotate. A casing covers this band, and has a lever at one side, with a cam attached, as shown.

When this lever is moved from the center by the conical-shaped collar upon the shaft, it brings the cam in contact with one of the lugs upon the band compressing it upon the hub of the pulley, thereby compelling the shaft to rotate. Upon moving the conical-shaped collar back toward the center to its former position, the cam lever releases the friction band, and the shaft stops.

The wear of the band may be compensated for by adjusting the set screw in the case. The point of this set screw bears against one of the lugs upon the friction band directly opposite the cam. It will be seen that this device is at once simple and efficient. One of the chief objections to a friction clutch has been in this device eliminated. That is the necessity of a long lever. In this clutch a strong pressure is applied to the friction band, without the necessity of a long leverage, with only a light pressure upon the shipper.

At the recent meeting of the Institution of Mechanical Engineers, in England, Mr. Fielding exhibited some cast-iron chilled tools, and said that with chilled tools—the cost of which he showed to be merely nominal—he was able to turn cast and wrought iron and gun-metal at from 50 to 100 per cent. higher speed than with tools made from steel. He expressed surprise that such tools had not come into more general use.

Nature says there are 12,000 miles of underground telegraph wire in the United Kingdom. The cost of underground wire per mile is four times that of overground, while the capacity of the latter is four times that of the former.

Using Twist Drills.

FROM A PAPER READ BY W. FORD SMITH BEFORE THE INSTITUTION OF MECHANICAL ENGINEERS, ENGLAND.

During the last-thirty years many attempts have been made to introduce a better system of drilling and boring.

Many engineers have used square bar steel, which the blacksmith has twisted and then flattened at one end to form a drill. The object of the twisted stem was to screw the cuttings out of the hole, and to some extent this succeeded, but not perfectly.

The twisted square section revolving in the round hole had a tendency to crush or grind up the cuttings; and if they were once reduced to powder it was difficult (especially in drilling vertically) for the drill to lift the powdered metal out of the hole. In most cases the lips of these drills were of such form that the cutting angle, or face of each lip, which ought to have been about 60°, was 90° or even still more obtuse; this being an angle which would scrape only, but could hardly be expected to cut sweetly or rapidly.

Again, there were attempts to make the cutting angles of the two lips of much the same number of degrees as that given by the twist itself in a good twist drill. This was done by forging or filing a semicircular or curved groove on the lower face of each lip. For a short time lips thus formed cut fairly well, but a very small amount of regrinding soon put them out of shape and made them of such obtuse cutting angles that good results could no longer be expected from them, and to be constantly sending such drills to the jobbing or tool smith and then to the fitter to file into form again before they were re-hardened was found to be too tedious and too expensive.

Again, to arrive at the best results in drilling each of the cutting lips should make the same angle with a central line taken through the body of the drill; in other words, the angles should each have exactly the same number of degrees, say 60°. The clearance angles also should be identical, and the leading point should form the exact center point of the drill.

From practice it is found that if these proportions are not correct, the drill cannot pierce the metal it is drilling at more than about half the proper speed, and the hole produced will also be larger than the drill itself.

To give an idea of the excessive accuracy which must be imparted to a twist-drill we must bear in mind that even a good feed is only $\frac{1}{100}$" to each revolution; and as two lips are employed to remove this thickness of metal, each lip has only half that quantity to cut, or $\frac{1}{200}$". This $\frac{1}{200}$" is as much as can be taken in practice by each lip in drills of ordinary sizes.

It will therefore be readily understood that if one lip of a drill stands before the other to the extent of $\frac{1}{100}$ inch only, the prominent lip, or portion of a lip, will have to remove the whole thickness of the metal

from the hole at each turn. The lip of a drill will not stand such treatment; and it is therefore obvious that if this were attempted the prominent lip would either break or become too rapidly blunted. To get over these difficulties, the driller would no doubt reduce his feed by one-half, or to $\frac{1}{200}$ inch per turn, which would mean about half the number of holes drilled in a given time. This nice accuracy, although absolutely required, cannot be produced by hand-grinding; neither can a common drill, having a rough black stem more or less eccentric, be ground accurately, even by aid of a grinding machine with mechanism for holding it. To grind any drill accurately, it must be concentric and perfectly true throughout with the shank, as that part has to be held by the drill-grinding machine. If the drilling is to be done in the most rapid manner—in other words, at the smallest cost—and if the best class of work is also desired, it seems certain that a twist drill, with all the accuracy which can possibly be imparted to it in its manufacture, and the greatest care employed in the re-sharpening, is the only instrument which can be employed.

About a quarter of a century ago both Sir Joseph Whitworth and the late Mr. Greenwood, of Leeds, made some twist drills; but it is to be presumed that a large amount of success was not achieved with them, and for some reason the system was not persevered with. After that period the Manhattan Firearms Company, in America, produced some beautifully-finished twist drills. Though the workmanship in these was of a superior description, the drills would not endure hardship. It was found that the two lips were too keen in their cutting angles, and that they were too apt to drag themselves into the metal they were cutting, finally to dig in and to jam fast, and to twist themselves into fragments. Mr. Morse then took the matter up, and by diminishing by about 50 per cent. the keenness of the cutting lips of twist drills, made a great success of them. He used an increasing twist. In such a drill of the standard length, and before it is worn shorter by grinding, the twist is so rapid towards the lips that the angle they present, or what has been already referred to as the angle of the cutting surface, is very nearly the same as that the writer had previously established for cutters cutting metals.

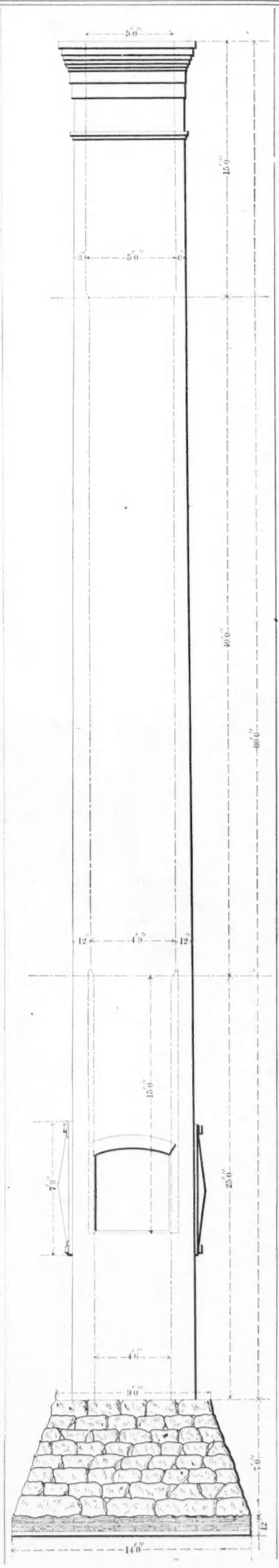
It is therefore obviously advantageous to adopt from the first the best cutting angle for all twist drills, and to preserve this same angle through the whole length of the twisted part, so that, however short the drill may be worn, it always presents the same angle, and that the most efficient which can be obtained. This angle is easy to fix, and becomes an unalterable standard which will give the best attainable results.

A common drill may "run," as it is usually termed, and produce a hole which is anything but straight. This means that the point of the drill will run away from the denser parts of the metal it is cutting, and penetrate into the opposite side, which is soft and spongy. This is especially the case in castings; where, for instance, a boss may be quite sound on the one side, while on the other a mass of metal may be full of blow-holes, or so drawn away by contraction in cooling as to be very soft and porous. In such cases it is perfectly impossible to prevent a common drill from running into the soft side. This sort of imperfect hole is most trying to the fitter or erector, and if it has to be tapped, to receive a screwed bolt or stud, is most destructive to steel taps. The taps are very liable to be broken, and an immense loss of time may also take place in attempting to tap the hole square with the planed face. A twist drill, on the other hand, from its construction, is bound to penetrate truly, and produce holes which are as perfect as it is possible to make them.

The next important step in twist drills has been to fix a standard shape and angle of clearance for both lips, which should also give the best attainable result. This angle might be tampered with if the re-grinding were done by hand, and too much or too little clearance might easily be imparted to the drill from want of sufficient knowledge on the part of the workman. If too little clearance, or in some cases none at all, is given to the drill, the cutting lips then cannot reach the metal, consequently they cannot cut. The self acting feed of the drilling machine keeps crowding on the feed until either the machine or the drill gives way. Usually it will be the latter. Again, if too much clearance is given, the keen edges of the lips dig into the metal, and embed themselves there, and of course break off. The grinding line was introduced in the States to assist the operator in keeping both lips of the drill identically the same. To arrive at this, however, is more than can be accomplished by hand-grinding, as not less than three points have to be carefully watched, viz.:—1st. That both lips are exactly the same length. 2nd. That both have the same clearance angles. 3rd. That both make the same angle with the center line on the body of the drill. If these are not attended to, the drill lips may for instance be both ground so as to converge exactly to the grinding lines at the point or center of the drill, and may still be of such different lengths and angles as to produce very bad results in drilling.

The whole of the drilling in many establishments is now done entirely by twist drills. Since their introduction it is found that the self-acting feed can be increased about 90 per cent.; and in some engineering works the feeds in some machines have been increased by fully 200 per cent., and consequently three holes are now being drilled in the same time that one was originally drilled with the old style of drill and with old machines. It may be interesting to give a few results out of numerous tests and experiments made with the twist drills. Many thousands of holes $\frac{1}{2}$ inch in diameter and $2\frac{1}{2}$ inches deep have been drilled, by improved $\frac{1}{2}$ inch twist drills, at so high a rate of feed that the spindle of the drilling machine could be seen visibly descending and driving the drill before it. The time occupied from the starting of each hole, in a hammered scrap-iron bar, till the drill pierced through it, varied from 1 minute 20 seconds to $1\frac{1}{2}$ minute. The holes drilled were perfectly straight. The speed at which the drill was cutting was nearly 20 feet per minute at its periphery, and the feed was 100 revolutions per inch of depth drilled. The drill was lubricated with soap and water, and went clean through the $2\frac{3}{4}$ inches without being withdrawn; and after it had drilled each hole it felt quite cool to the hand, its temperature being about 75°. It is found that 120 to 130 such holes can be drilled before it is advisable to re-sharpen the twist drill. This ought to be done immediately the drill exhibits the slightest sign of distress. If carefully examined, after this number of holes has been drilled, the prominent cutting parts of the lips, which have removed the metal, will be found very slightly blunted or rounded, to the extent of about $\frac{1}{10}$ of an inch; and on this length being carefully ground by the machine off the end of the twist drill, the lips are brought up to perfectly sharp cutting edges again.

The same-sized holes, $\frac{1}{2}$ inch diameter and $2\frac{3}{4}$ inches deep, have been drilled through the same hammered scrap iron at the extraordinary speed of $2\frac{3}{4}$ inches deep in one minute and five seconds, the number of revolutions per inch being 75. An average number of 70 holes can be drilled in this case before the drill requires re-sharpening. The writer considers this test to be rather too severe, and prefers the former speed. The drills in both cases were driven by a true-running drilling-machine spindle, having a round taper hole, which also was perfectly true; and the taper shank and body, or twisted part of the drills, also ran perfectly concentric when placed in the spindle, or in a reducer, or socket having a taper end to fit the spindle. When the drills run without any eccentricity, there is no pressure, and next to no friction, on the sides of the flutes; the whole of the pressure and work being taken on the ends of the drills. Consequently, they are not found to wear similar in diameter at the lip end, and they retain their sizes, with careful usage, in a wonderful manner. In London upwards of 3,000 holes were drilled $\frac{5}{8}$ inch diameter, and $\frac{5}{8}$ inch deep, through steel bars, by one drill without regrinding it. The cutting speed was in this instance too great for cutting steel, being from 18 to 20 feet per minute; and the result is extraordinary. Many thousands of holes were drilled $\frac{1}{8}$ inch diameter, through cast iron $\frac{7}{16}$ inch deep, with straight-shank twist drill gripped by an eccentric check in the end of the spindle of a quick-speed drilling machine. The time occupied for each hole was from nine to ten seconds only. Again, $\frac{1}{4}$ inch holes have been drilled through wrought copper, $1\frac{5}{8}$ inch thick, at the speed of one hole in ten seconds. With special twist drills, made for piercing hard Bessemer steel, rail holes, $\frac{13}{16}$ inch deep and $\frac{20}{32}$ inch diameter, have been drilled at the rate of one hole in one minute and twenty seconds, in an ordinary drilling machine. Had the machine been stiffer and more powerful, better results could have been obtained. A similar twist drill, $\frac{20}{32}$ inch in diameter, drilled a hard steel rail $\frac{11}{16}$ inch deep in one minute, and another in one minute ten seconds. Another drill, $\frac{5}{8}$ inch diameter, drilled $\frac{3}{4}$ inch deep in 38 seconds, the cutting speed being 22 feet per minute. This speed of cutting rather distressed the drill; a speed of 16 feet per minute would have been better. The steel rail was specially selected as being one of the hardest of the lot.



New's New Chimney.

The accompanying engraving is that of a new chimney recently erected at the works of Tobias New, manufacturer of roofing materials, office 32 John street, New York.

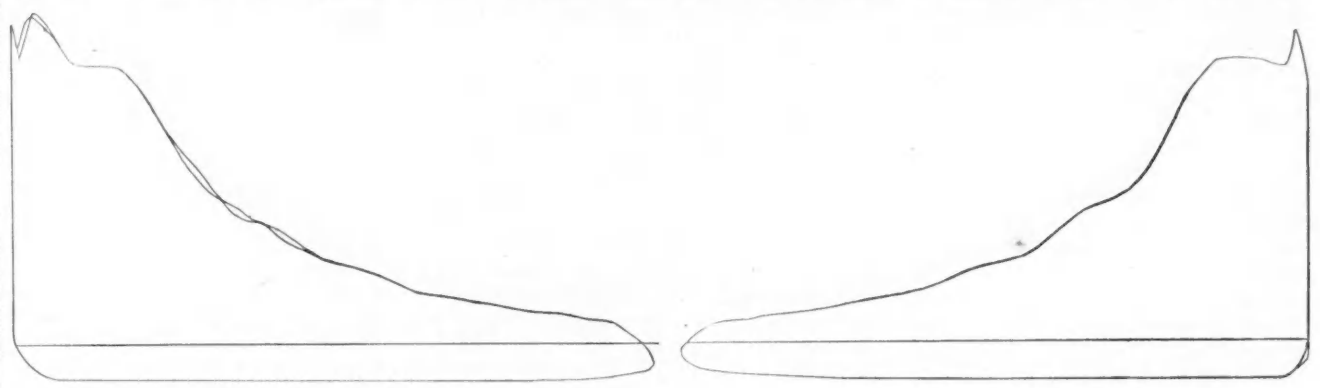
This chimney was built upon what would be generally considered questionable ground, inasmuch as water was reached a few feet below the surface of the earth, and the bottom upon which the foundation was laid did not present indications of being of a rigid character. However, the proprietor decided that it was safe to erect the chimney. A hole was dug eight feet deep, and the muddy bottom carefully leveled. A layer of spruce plank 3″ thick was placed upon the bottom, with a similar layer of plank of the same thickness laid at right angles to the first. These planks were spiked together, after which a third layer was placed at right angles to the second, and finally a fourth layer at right angles to the third, all of which were well spiked as they were laid, making in all a timber foundation 12″ thick. A course of large boulders was then laid in a bed of cement, upon which the pyramid was built up of bluestone. The water level is from 8″ to 10″ above the top of the timbers, so that they always remain under water. The chief peculiarity of this chimney is that it is a single wall. Its total height from surface of ground is 80 feet. The lower part of the wall, to a height of 25 feet above the ground, is 16″ thick; the next 40 feet is 12″; and the remaining 15 feet is 8″ in thickness. The inside at and above the flue for a distance of 15 feet is lined with fire-brick, as shown. The main flue is 4′ 6″ square at the bottom, and 5′ 10″ at the top. This chimney is capped with stone, covering a plain brick top. At the flue it is braced with buck-staves. The foundation contains 1,008 cubic feet of bluestone, 98 cubic feet of concrete and broken stone, and the chimney 2,000 No. 1 fire brick, and 40,000 Haverstraw brick.

The mason-work was done by Berton & Nickel, 422 East Twenty-third street, New York.

There are three boilers, of 85-horse power each, connected with this chimney, having 80 tubes 3″ × 15′ 0″, making in the aggregate 240 tubes of 3″ diameter. It will be observed that the flue area is large in proportion to the tube area, which allowance has been made with the intention of adding power when required. It was predicted before the chimney was built that it would crack, but it has not, neither has it settled one-fourth of an inch. The boilers are set with the Jarvis setting, and the draft is excellent.

The cost of the chimney complete was $1,350.

The Willimantic Porter-Allen Engines.



We present with this an engraving representing one pair of the Porter-Allen engines, built by the Southwark Foundry and Machine Company, Philadelphia, Pa., for the Willimantic Linen Company. There are in use by this company three pairs of these engines, each pair driving by direct connection 800 feet of shafting, and developing from 200 to 250 horse power. The cylinders are 11½″ × 16,″ and the speed is 350 revolutions per minute. We also show engravings representing the eccentric and link, and sections of the cylinder, for a description of which we copy from the recent treatise on the Porter-Allen engine, written by Mr. Porter:

The eccentric is placed on the shaft in the same position with the crank, instead of at right angles with it, as it is in the ordinary valve gear, and it cannot be advanced from this position. The lead of the valves is adjusted by other means. The first requirement in this system is, that the crank and the eccentric shall have coincident movements, and so shall arrive on their dead points, or lines of centers, simultaneously. To insure the permanence of the eccentric in its correct position, and also for compactness, and as a superior mechanical construction, it is formed in one piece with the shaft, and its low side is brought down to the surface of it, as shown. The construction of the link is also shown in the cut. It is of the form known as the stationary link, and consists of a curved arm, partly slotted, formed in one piece with the eccentric strap, and pivoted, at its middle point, on trunnions, which vibrate, in an arc whose chord is equal to the throw of the eccentric, about a sustaining pin, secured rigidly to the bed. The radius of the link is equal to the length of the first rod by which its motion is communicated to the admission valves. Only the upper end of the link is here shown, being the portion used in engines which are to run in the forward direction; backward running engines require the lower end, and in reversing engines, of course, both ends are employed.

In the slot is fitted a block from which the admission valves only, receive their motion. This block is moved by the action of the governor, which thus varies the point of cut off. If the center of the block is brought to the center of the trunnions, the port is not opened at all, except by the lead given to the valves, and this opening is closed before the piston has advanced a sensible amount. If, on the other hand, the block is brought to the end of the slot, as here represented, the steam is not cut off until the piston has reached the half stroke, which is the usual limit of the admission, although, where great power is occasionally required, as in rolling mills, the steam is admitted through five-eighths of the stroke.

The exhaust valves are driven from a fixed point on the link, and have, of course, an invariable motion. The movements of the link, at this point, are admirably suited to this function, causing the steam, wherever it may have been cut off, to be held until near the termination of the stroke, when it receives a free and ample release, and is confined again at nearly the same point of the return stroke.

The valves are four in number, as shown in the sections, on page 5, one for admission and one for release, at each end of the cylinder. They stand in the vertical position, the admission valves on one side of the cylinder and the exhaust valves on the opposite side, and the latter are so placed as completely to drain the cylinder. These valves work between opposite parallel seats, the exhaust valves nearly and the admission valves wholly in equilibrium. Means are provided for taking up wear, in the exhaust valves automatically, and in the admission valves by hand, so as to keep them perfectly steam-tight. Each valve opens simultaneously four passages, two on each face, for the admission or release of the steam. The exhaust valves are opposite to the steam-chest and are in contact with only a small portion of the cylinder, so that the exhaust abstracts externally but little heat from the cylinder, and none at all from the entering steam. The valves are all very convenient of access; each one lies in its own chamber, and is capable of independent adjustment.

The construction of these pressure plates and the method of adjusting them are fully represented in the sections of the cylinder. On the lower side of the horizontal section both admission valves are shown, working between their opposite parallel seats, one of which is formed on the cylinder, and the other on the pressure plates, the latter having cavities opposite the ports. The valve at the farther end of the cylinder is at the extremity of its lap, while the one at the crank end has commenced to open the four passages for admission of the steam.

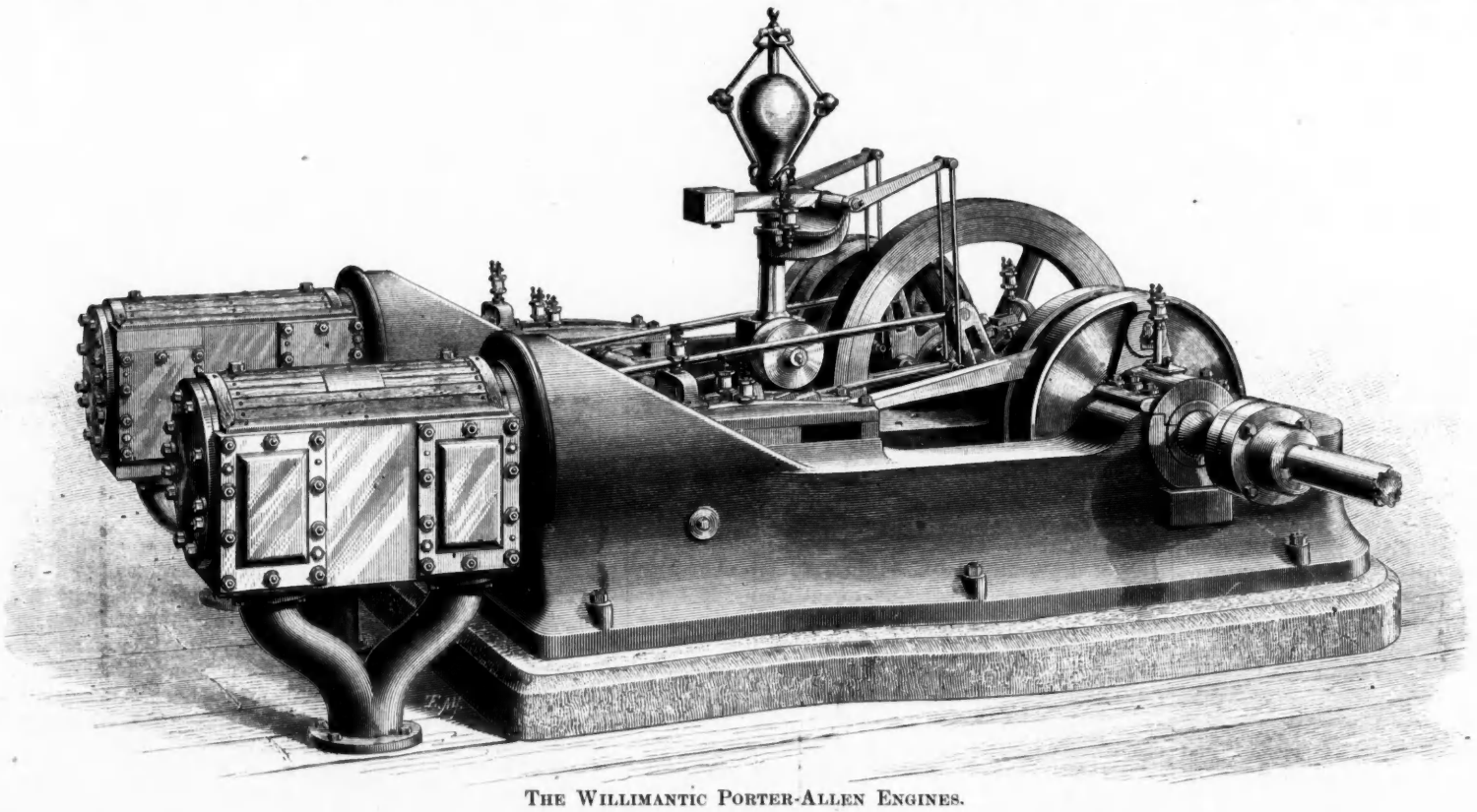
The vertical cross-section passes through the middle of one pressure plate, and shows its form, and the means employed for its adjustment. It is made hollow, and most of the steam supplied to two of the openings passes through it. It is arched to resist the pressure of the steam without deflection. It rests on two inclined supports, one above and the other below the valve. These inclines are steep, so that the plate will be sure to move freely down them under the steam pressure, and also that it may be closed up to the valve with only a small vertical movement. It is prevented from moving down these inclines by a screw passing through the bottom of the chest, the point of which, as also the plug against which it bears, is of hardened steel.

The pressure plate is held in its correct position by projections in the chest on one side, and tongues projecting from the cover on the other, which bear against it near each end, as shown. Between these guides, it is capable of motion up and down its inclined supports, and also directly back and forth between the valve and the cover, from which it is separated by a space varying, in the different sizes, from one-sixteenth to one-eighth of an inch. The pressure of steam is always on this plate, and tends to force it down the inclines, to rest on the valve. By means of the screw, it is forced, against the steam pressure, up the inclines, and away from the valve. This adjustment is capable of great precision, so that the valve works with entire freedom between its opposite seats, and still is steam-tight. Whenever the pressure in the cylinder exceeds that in the chest, the pressure plate is instantly moved back to contact with the cover; thus affording an ample passage for the discharge of water before it can exert a dangerous strain.

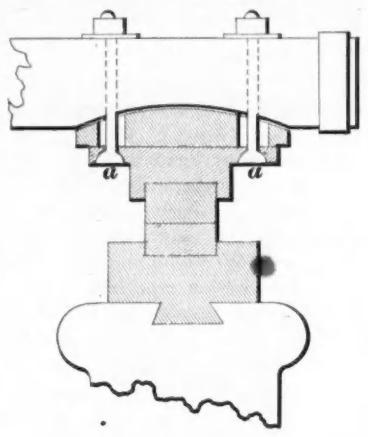
The exhaust valves are similar to the admission valves in their form and operation, which are also fully shown in the sections of the cylinder. Behind each one is an open frame, held to the cover by a copper diaphragm, and the edge of which forms one of the seats between which the valve works. The cover projects to fill this frame, except a cavity left opposite the port for one of the steam currents, and guides on this projection hold the frame from moving with the valve.

The steam has access from the cylinder to the back of the diaphragm, and keeps the frame in contact with the valve. The pressure coming on the valve is limited to that on the surface of the frame, and one-half the exposed portion of the diaphragm; and from this is to be deducted the counter-pressure between the working surfaces. The pressure, which in ordinary valves is due to the port areas, is entirely avoided, that which is received on the valve falls with the expansion in the cylinder, and on the return stroke the valve is free. The wear is trifling, and the elasticity of the diaphragm permits the frame to follow this up, and at the same time prevents the valve from ever being seized between its opposite seats, through unequal expansion. A form of the Corliss wrist motion is introduced into the connection of the admission valves, which effects a useful modification of their movements. In this movement, an arm connected by a rod with a block in the link, communicates through a rock shaft, motion to two other arms, causing them to vibrate in the same vertical plane in which the valve moves. This modification effects the opening and closing of the valves with rapidity.

The diagrams, scale $\frac{1}{50}$, are fair representatives of those taken from this pair of engines, the weekly record being 1 horse power for 24 lbs. of water per hour. No account is taken of the steam used to run the steam pump furnishing water to the injector condenser, which, if deducted, would show less water consumption by the engine. It may also be noted that the cranks of the pair of engines were set, at the request of the purchasers, so as to secure the greatest readiness in starting from any position, without reference to the greatest economy in the use of steam.



THE WILLIMANTIC PORTER-ALLEN ENGINES.



Setting Trip-Hammer Dies.

BY B. F. SPALDING.

If all the dies for the trip-hammer are of the same height, there is no difficulty in setting the head on the valve so that they will all strike level; but as the heights of the dies change from time to time, as they wear out and are repaired, some device becomes necessary to adjust them, so that they will strike fairly for their whole length.

All trip-hammersmen know that the head of the hammer rises in a circle, the center of which is the husk or journal on the tilting motion; and, as the distance from this center to the outside of the head is greater than to the inside, it follows that the outside must rise faster than the inside, and, allowing the face of the dies to be on a level with the centers, a pair of high dies will have a greater difference between the outer and inner ends than a pair of low dies. It has always been difficult to get this difference with the absolute accuracy which is demanded by the laws of percussion and economy. In old times, when it became necessary to set a pair of dies, there were two methods of adjustment available. One was by driving wedges under the tenants of the dies, and the other was by wedging the top of the hammer head backwards or forward. The last method not being convenient, was seldom resorted to, unless the dies were to be used for a long time, and the former method was objectionable, because its continued practice made the bottom of the die seat so irregular that it soon became a hard matter to get a firm, solid bearing for the die to rest on. On the same principle that more corn grows in crooked rows than in straight rows, so more iron was trip-hammered on dies that did not have a good seating than on dies that set in straight, clean die seats.

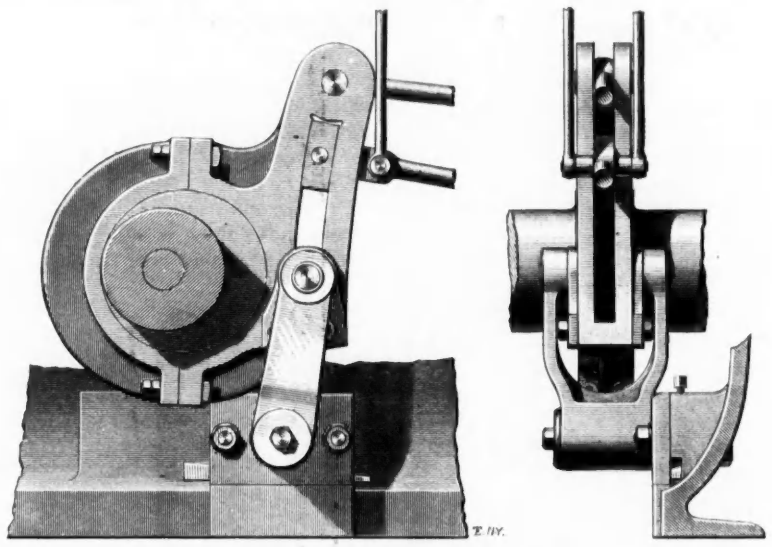
Even for a long time after the Lawrence and Holyoke people began to put cast-iron frame trip-hammers upon the market, with heads that bolted on, instead of being tenanted into the helves, there were no means provided for this adjustment of inclination of the dies, except by inserting wedge-shaped packing between the head and helve, and this was always a great trouble, as the lower side of the helve was likely to be battered up by previous packing, so that, as a rule, the dies had to be brought to a good bearing by the slow and sure processes of cutting and trying. This was and is very annoying, but there are a great many hammers in use at the present day on which this is done, or in which the dies are wedged under the tenants. On a trip-hammer it is probably better to do this than to alter the height of the boxes.

On hammers like the Bradley, Long & Alstatter, or Penney's, which, in the severe meaning of words, are not trip-hammers, but tilt-hammers, the altering of the height of the tilting centers is not objectionable, and the last hammers I have seen from these manufacturers were calculated to be adjusted in this manner.

A great many workmen would rather make all the adjustments at the front end, and the anvil blocks which can easily be moved sideways in these late hammers are a great convenience, as by this arrangement, in combination with the longitudinal die seats, the workman can set his dies either lengthwise or sidewise without going away from them to another part of the hammer.

It is also an advantage to the workman to be able to adjust his dies for inclination at the front of the hammer, and to do this the best way I have ever seen is to use the segment of a circle between the head and helve, as shown in the engraving. It is a very cheap and excellent device for helves that are from five to nine inches through at the forward end. A good way to make it is to saw out of half-inch stuff a template of a part of a circle of forty four inches in diameter; then cut a piece of thoroughly seasoned horny hickory, the width of the helve and two inches longer than the hammer head, so that it will just fit into the circle, and be three-quarters or one inch thick at the ends. If it is twelve inches long, it will be one and one-half to one and three-quarters thick through the middle, and if it is eighteen inches long, it will be two and five-eighths to two and seven-eighths through the middle. Cover the convex side of this with steel three-sixteenths of an inch thick—or iron a quarter of an inch thick will answer—and fit it to the under side of the helve for a space the length of the hammer head; then bore bolt holes through it for the bolts that hold the hammer head on, and slot them through the segment an inch each way forwards and back. Now, putting the whole thing together, the segment can be moved one inch each way from a central position, which, on a pair of dies six inches long, will give a capacity of adjustment which allows dies to vary in the proportionate height at heel and toe one-half of an inch. If they need greater adjustment than this, it will be well to have them refitted.

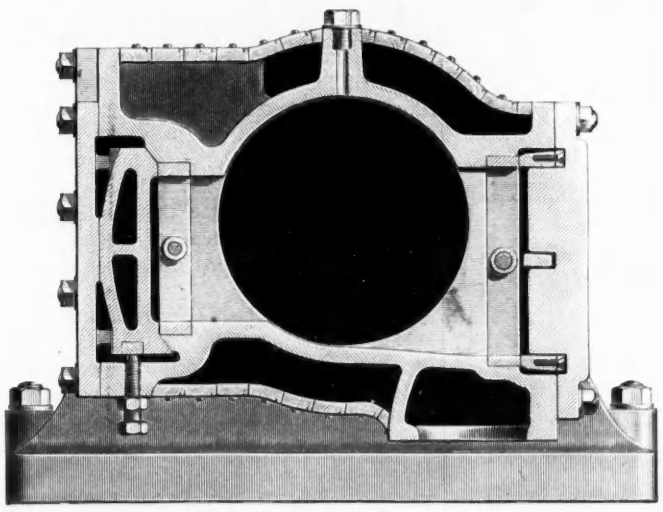
To make an adjustment of one-half of an inch difference of inclination on a pair of dies six inches long by raising the tilting the dies by cutting out the worn-out die seat in an anvil block and putting an iron segment of a lesser circle therein. It has been in use nearly three years, and has given good satisfaction. The die seat should not be dovetailed.



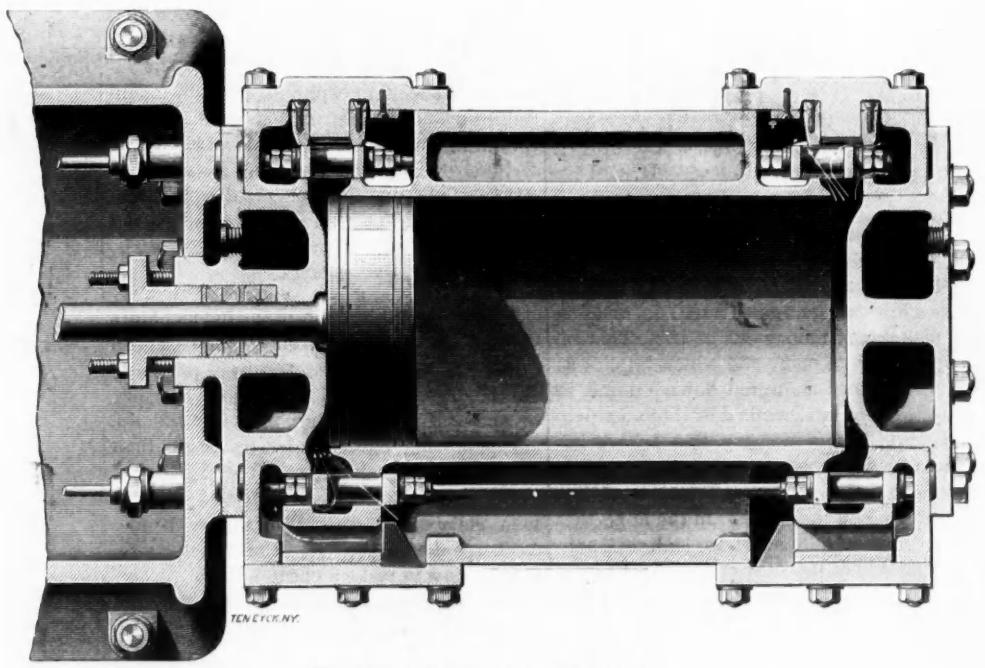
ECCENTRIC AND LINK.—See page 4.

In discussing "The New United States Tariff" the *Mechanical World* of Manchester, England says: "We believe we are not mistaken in anticipating an increase in the volume of business in connection with mechanical engineering not only due to the actual reductions in the tariff, but also, now that the ball has been set rolling, because it will have such an effect upon the American people that they will demand further concessions and reductions, which will still increase their prosperity and in some measure react upon ourselves. No doubt it will be those engineers and manufacturers who are first in the field that will benefit by the new departure, and we are convinced that the outlook is encouraging." Possibly our English contemporary may be somewhat mistaken about what the American people will demand as a means to increase their prosperity. It is a significant fact that the changes in the tariff have not produced any such encouraging outlook on this side of the Atlantic. Quite a number of people in this country still maintain the old notion that prosperity is not advanced by producing less at home and buying more from abroad. Still, opinions differ.

Joseph D Hollister, has resigned his position of Master of Machinery of the Savannah, Florida, and Western Railway to accept the position of Superintendent of the Florida Southern Railway. His office is at Palatka, Fla.



CROSS-SECTION OF CYLINDER.



HORIZONTAL SECTION OF CYLINDER.

The American Furniture Gazette in discussing the installment plan of selling furniture, very justly says:

"To the dealer the profits are enormous and the danger of loss very small—for the first deposit nearly pays the cost of the goods,—but in order to reap these profits he must be a man utterly without conscience, decency, or any attributes much above those of the brute creation. Consequently the business has been steadily drifting into the worst hands, and probably no meaner scoundrels unwhipped of justice can be found than some of the East side dealers of New York City.

"Day after day the papers report cases of the grossest outrage and wrong and unquestionably only a tithe of these swindles come to light."

Meriden, Conn., and Cincinnati, O, have lately formed local associations of Stationary Engineers. Elmira, N. Y., Auburn, N. Y., Cherokee, Kan., and Fall River, Mass, are about to form associations. These are tributary to National Association formed last fall.

LETTERS FROM PRACTICAL MEN.

Grinding Twist Drills.

Editor American Machinist:

I see in your issue of May 5th a question with regard to difficulties in using twist drills. I have had a great deal of experience in the use of twist drills. As your correspondent says, the larger sizes are more apt to run than the smaller; but if he will try, I think the following rules will help him very materially:

1st. Be very careful to grind the lips at the same angle (this can be very easily decided with a bevel).

2d. Be sure that the lips are of the same length.

2d. Grind the cutting face as flat as you can, and get a good clearance.

4th. Don't grind the lips too long, as there is nothing gained by this.

I sometimes find that by using a small drill just to start the center I can get along faster and easier; that is, I don't have to do what we call draw the center, as I do when drilling from a prick punch.

A great many men—some that are called first-class—still stick to the old style of grinding twist drills, the same as was used in the days of flat drills, viz., grind one lip and then make an impression on a board, and grind the other to it. I will guarantee that no man can drill a hole straight or round with a drill ground in this way.

I once worked in a shop with a man that had a notion of grinding in this way. He never could get two holes alike, and all of them (or at least most of them) had the rifled appearance spoken of by your correspondent. He came to me one day and admitted that he did not know how to grind a twist drill. I took considerable pains to show him, and even ground a drill for him. It was 1¼" diameter. He used it until dull without any trouble, but when he came to grind it had quite a job before he got it right; in fact, it was some time before he could grind it to cut as it ought. If what I have written will be of any benefit to any machinists experiencing such difficulties, my object in writing it will be accomplished. H. C. D.

Cheapness in Production.

Editor American Machinist:

"If you can build it cheap enough and sell it for a low enough figure, it will do, and you can make some money out of it." This remark, so easy to make and which implies so much, has been showered down on me so many times of late, while debating about entering into a new industry, that I have imbibed a new consciousness of its meaning. This leads me to present some points of history bearing on the subject, in the hope that others may be influenced to look at more than one side of the subject before settling it as a fact that a thing must be cheap to sell.

* * * * * *

A minister of the Gospel, so the story goes, became possessed of the idea, like Mrs. Langtry, that money was a good and (in his case as in hers) a very important thing to have. He did not appeal to the uncertainties of the stage, but resolved on the next most uncertain of all things—inventing. And to invent something out of which he could make some money, like a sensible man, he looked around for something to improve that every family was obliged to have. He hit upon the one thing, of all others, that was already perfect—the common dust-pan, in which a drop apron is put on in front, and a petticoat drawn over the wire arrangement at the back. The old one is simple, sells for ten cents, and costs nine to make it. The new article is formidable, and in a certain sense is better. It sells for fifty cents, costs perhaps twenty-five cents to make, and is selling like hot cakes.

* * * * * *

In '68 the velocipede fever struck the land. One or two concerns went into the business, built good machines, sold them for a good price, and made money. Two hundred other concerns could plainly see that if they could get up a good machine and sell it for a reasonable price—say $50, which, it seemed to them, was a hundred per cent. above necessary cost—they could sell them by the thousand and coin a million by the operation. The two hundred concerns tried it, took out their two hundred or five hundred patents, went into the business, found their $50 machines cost them $60 to build, and must be sold all the way down to $5 if they sold at all. Result—199 out of the 200 concerns made less than nothing.

* * * * * *

Thirty years ago, and from that time up, men have been inventing door springs. Each man thought he had got up a good one, and if he could make it cheap enough to sell it low, there was money in it. How many dozen, though, were not as good as a chunk of iron on the end of a string? Who has ever made much money out of the cheap door-spring business? Was the trouble because of the 50 cents or $1 too much that they cost? It hardly can be, when good door springs at from $12 to $20 are superseding all others. Is it really because these are so *much better?* I do not think so, but believe they sell more at $12 than at 12 shillings. *It's brass!*

* * * * * *

In London, fifteen years ago, an American had a type-writer so simple and perfect that it could have been made and sold at a profit for $10 each. It was based on a fundamental principle superior to the present drumstick sort. It was quick and reliable, and not larger than a fair-sized book. The inventor was seeking capital to assist in manufacturing and introducing his invention. He sought in vain and died from want. Type-writers are common to-day at from $90 to $125, made in numbers and sold at a profit. Should any man make equally good type-writers, and offer them at $10 each, he would ruin the business.

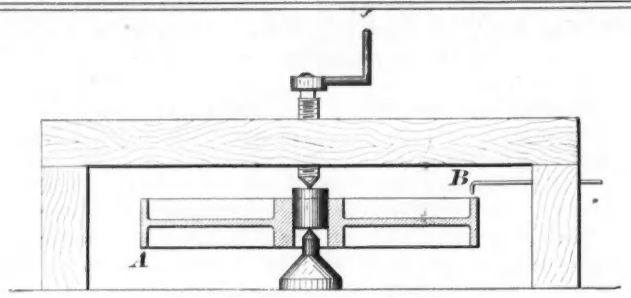
* * * * * *

I wonder if the builders of sewing machines study for cheapness? Do cheap pianos, cheap billiard tables, and cheap furniture pay best? Do the firms that build the cheapest wagons, or the cheapest mowing machines, or the cheapest bank locks double up faster than those who build the best? It would be interesting to know if Bement & Son, or William Sellers, or Pratt & Whitney, or Brown & Sharpe devote their best energies to studying out how to make a cheap lathe or planer. Would they sell any more if they did, and would they make half as much money?

* * * * * *

There are lots of engine builders who can build their engines for half the money Corliss asks for his. The engine is "so much more simple, so few pieces," &c. Yes, and they can and do sell them for half the money, and have kept right on until they have neither money nor reputation.

Looking at these things, does it not seem as if this scheming for cheapness in production had been overdone? J. O.



Pulley Balancing Device.

Pulley Balancing Device.

Editor American Machinist:

Inclosed you will find a sketch of a device for balancing pulleys. It consists of a frame of wood with a screw center inserted at the middle of the upper part, as shown. A stationary center is secured to the lower part in line with the screw center. The process of balancing pulleys with this device is simply this: First, balance the pulley upon the mandrel upon the centers of a lathe, then put it between the centers of the balancing device, as shown at *A*. Make the pulley rotate quickly, and wait a few moments until it runs steadily, then apply a small brush dipped in red lead and oil, or paint, at *B*. The place where the brush strikes the edge of the pulley will indicate one of the localities where more metal will be required.

J. Begtrup.

Syracuse, N. Y.

Another New Surface Gauge.

Editor American Machinist:

We inclose you a sketch of a surface gauge shown in the accompanying engraving, which for nicety of adjustment has not been excelled by any tool of the kind that has appeared in the American Machinist.

The base and standard of this (see Fig. 1) are not unlike those of other similar tools The peculiarity consists of the method of adjusting the scriber point. How this is accomplished is seen by aid of the sectional engraving, Fig. 2. The clamp *E*, encircles the standard which passes through the hole *I*, and is held in any desired position by means of the thumb-nut *F*. The case shell *J*, contains a worm wheel *C*, which is operated by the worm *B*.

The scriber *H*, is pressed against the face of the worm wheel by the thumb-screw *D*, By turning the screw *G*, Fig. 1, the scriber point may be adjusted with the neatest and most minute precision. Patent *not* applied for.

Mallalieu & Lukens.

Hamilton, O.

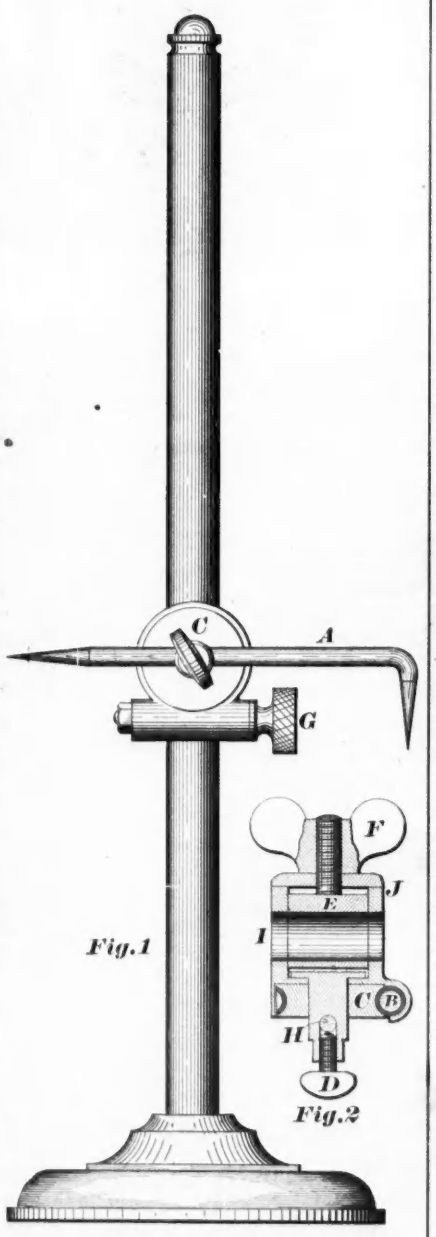


Fig. 1 Fig. 2

New Surface Gauge.

Suction Pipe Troubles.

Editor American Machinist:

The great length of suction pipe and the trouble that it gives, as stated by W. M., in question 165, in issue of May 5th, reminds me of a case which came under my observation in the early days of the Worthington pump. In a shop where I was at work, the water supply had been uncertain for some time, when a Worthington pump was procured and a suction pipe laid to the creek some 200 yards from the works. But there was trouble somewhere; no water would come. The joints, the pump valves, and foot valve at the creek were all examined in turn and return, and no cause of trouble found. A level was run and the greatest height of suction was only 22 feet, and this highest point was only a little knoll between the works and the creek.

Twenty-two feet height of suction seemed reasonable, and the conclusion was fast forcing itself upon the "powers that were" that the pump was not all that it was cracked up to be, when "one of them literary fellers" who are always reading scientific books and things whenever their day's work is done, said that according to the principles laid down by Ewbanks on Hydraulics and Mechanics, that high point on the knoll, was the cause of the trouble. The pump being below it, the air gathered at the high point and formed a long and very elastic spring, which would follow the pump plunger out and then not break, and would recoil again. He was set down upon very severely for offering his opinion unasked, but the pipe was lowered and then the pump worked all right. M.

Pullman, Ill.

A Planer on the Jack-Plane Plan.

Editor American Machinist:

In your issue of May 5th, Chordal has a good letter on planers. Near its close he says: "While on the subject of planers, how ridiculous it seems to take an immense planer table and pile on it a big long job, the whole thing weighing a hundred and some odd tons, perhaps, and then churn that immense thing backward and forward past a little cutting tool for hour after hour. How much more reasonable it is to think of the massive work lying still, and the little tool walking along it like a carpenter's gauge on the edge of a board. I have never been over the water, but I understand that some of the tool-building shops over there use some such jack-plane arrangement in connection with long work."

If Chordal had been "over the water" in 1867 at the Paris Exhibition, he might have seen just such a "jack-plane arrangement" weighing some thirty tons, and capable of planing nine feet wide, nine feet high, and twenty feet long. It was a magnificent tool and an object of great interest to visitors of all classes, but especially to Americans, most of whom found an examination of this planer just what many Americans are yet finding out when they go "over the water," viz., that many of the good things they find abroad come from the United States.

The little "jack-plane arrangement" referred to was made in Philadelphia by Wm. Sellers & Co. T. R. P.

Portland, Conn.

Indicator Cards from Two Single-Valve Engines Compared.

Editor American Machinist:

Prof. Sweet's indicator cards in your issue of April 14 are likely a fair sample of what the "straight-line" engine will produce. I have compared the middle pair of diagrams with a pair of cards taken from another form of single-valve engine (10"x15") making 150 revolutions per minute, and with reciprocating parts of sufficient weight to produce a normal initial acceleration of 20 pounds per square inch of piston.

The weight of the reciprocating parts of the 8"x14" I have estimated at 175 pounds, giving at 242 revolutions a normal initial acceleration of 40 pounds per square inch of piston.

Figures 1 and 2 (one-half size) are the cards from the 10″x15″ engine.

Figures 3 and 4 are the same cards modified by the action of the reciprocating parts, the shaded portion representing the actual diagram of force exerted against the crank-pin.

The triangular black figure at the end of each of the shaded diagrams shows the resistance to the crank-pin, offered by the compression.

Figures 5 and 6 exhibit the rotative effect upon the crank-pin.

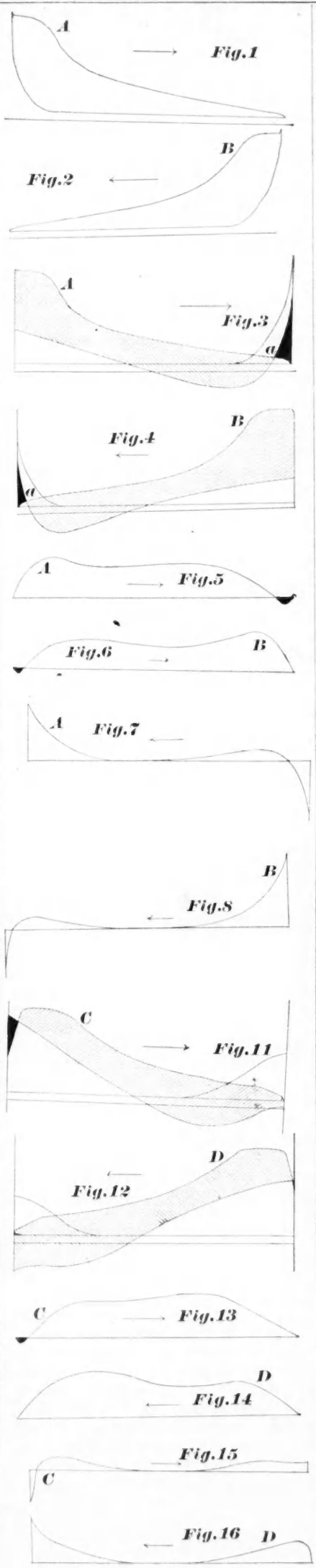
It will be observed to what extent the compression resists the crank at the terminal ends of these two diagrams.

Figures 7 and 8 indicate that proportion of the force transmitted which is exerted in merely producing friction upon the crank-pin and main bearings. The friction is not indicated, but only the pressure producing the friction. The frictional loss from this pressure depends mainly upon the conditions of lubrication, area of bearing surface, &c. Figs. 11 and 12 exhibit the cards from the 8″x14″, modified by the action of the reciprocating parts. The shaded portion shows the actual diagram of force, and the black triangles exhibit the resistance caused by the negative lead being inadequate to promptly overcome the inertia of the reciprocating parts. This effect is scarcely discernible in card *D*, but is very strongly marked in card *C*. Figs. 13 and 14 exhibit the rotative effect upon the crank-pin, the initial end of card *C* plainly indicating the drag of the reciprocating parts, owing to the tardy admission. Figs. 15 and 16 indicate the friction pressure, or that proportion of the total effect producing only friction.

In comparing the two engines it will be seen that the rotative effect is not practically very different, but the 8x14 shows considerably less friction, principally because the adjustments are such that there is an absence of excessive pressure upon the crank-pin just when it is passing the centers.

The action of the 10x15 engine could be much improved by appropriate adjustment, and the 8x14 would probably do better if the "drag area" could be removed from the initial end of card *C*. It would seem as though the 8x14, unless closely keyed up, would pound some just after passing the inner center by reason of the lost motion being suddenly reversed, when the admission pressure shoots above the pressure represented by the acceleration. With the 10x15, the lost motion is reversed by compression before the crank reaches the center.

CHAS. A. HAGUE.



About Twist Drills.

BY FRANK H. RICHARDS.

Your correspondent G. T. is looking for information about twist drills. So are we all of us—on some points. Most of us are looking, and thus far in vain, for a better drill. A twist drill certainly is not a perfect instrument. The dead flat point at the center of the drill is a great objection, and there seems to be no way to make it thinner with safety. When you start the drill upon a flat surface, it is very apt to waltz around in an ungraceful and most exasperating style. But don't fool with it long in that way. If you have had any experience in drilling, you have sometime struck a blow-hole in a casting, and you know how it will coax your drill from the path of rectitude. Well, let the blow-hole teach you a valuable lesson. Place a blow-hole where you want your drill to go, and you may be sure that your drill will follow it. Drill an $\frac{1}{8}$″ hole in your center, deep enough to let your twist drill cut its full size $\frac{1}{4}$″ deep or so before the little hole is obliterated, and there should then be no trouble about the drill getting out of place. Just shut your eyes and feed it down steadily and confidently. When I say drill an $\frac{1}{8}$″ hole, I don't mean $\frac{1}{4}$″. The little hole should be no larger than the blunt, flat center of the drill. Another way to start a twist drill is to clamp a plate upon the piece of work, with a hole in it just the size of the drill and serving as a guide for it. G. T. might by suitable means fix his drill firmly, point downwards, in a vertical position, and fasten his piece of work upon a revolving table, the center of the desired hole coincident with the axis of revolution. Then, the table being set in motion and at the same time steadily raised by a feed screw, a very satisfactory hole should result, if our friend conducted the operation as carefully as he tells us he grinds his drill. We might fasten our front door, and swing our house around upon the hinges when we wanted to go in and out. We have plenty of that operation on the planer, and there is no reason why it should not be equally satisfactory with a drill.

Running the drill fast has nothing to do with starting it truly. We use speed for circular saws and centrifugal drying machines, but with a different object.

As to the twist of the drill leaving its mark upon the side of the hole, it is an experience I never encountered. I should say that one lip of the drill was longer than the other, so that the point of the drill was not in the center, and the lip of the drill was thus crowded against the side of the hole, and of course it made its mark there. It might be also that the lip was ground away too much behind. The grinding of the drill as it comes from the maker is about right, and subsequent regrinding should accurately preserve this shape.

As a general rule in machine shop practice, the better the tool the less the liberty allowed as to the conditions under which it is to be used. A twist drill is exacting in its requirements, and only by compliance with them can the best work be done. It cannot be operated with the highest success by a slouch. The work must be firmly held in position, and in the right position, and the drill must be absolutely true and rigid, to do a first-class job. The drill must be ground truly, *and must be kept sharp*, if you want it to enjoy a long and useful life. It will work better, just as a man will work better, by being crowded a little. It is made to roll out respectable shavings, and not to scrape away impalpable dust. It has so little clearance at the side that, if the corner of the lip be not kept perfectly sharp, it works hard and heats up, and then wears very fast. The lack of sufficient clearance in the factory-made twist drill renders it incapable of the very highest performancce.

In 1857 I drilled with a home-made twist drill 40 feet of $\frac{1}{4}$″ holes in cast iron without grinding the drill. I have never been able to do as well with a factory made drill Though I instance the performance of a small drill, I have a great respect for larger ones and have seen admirable work done by them up to 2″, and our friend's experience must have been peculiarly unfortunate when it leads him to disparage them.

Speaking of feeding a drill reasonably fast, I am quite of the opinion that a tool will retain its cutting edge longer and better under a liberal cut than when only working to one-quarter or one-tenth of its capacity. A tool advancing steadily into its work may be said to be running down hill, and is by that means preserving its clearance, while a tool that is just scratching the surface is running on level ground and wearing away what clearance it originally had. This is an argument for feeding planer tools while cutting, instead of during the return stroke.

A twist drill is not very suitable for brass work, having too much hook to the lip and drawing itself into the work, especially when going through the hole. It may be made to work pretty well by grinding away the front of the lip. The Farmer lathe drill seems to be better suited, and is extensively used for brass work. It has, however, a weakness of its own. Any straight drill of that type is ill adapted to resist torsion, and the least catch or overcrowding gives it a backward twist, which not only deranges its external dimensions but makes it very hard for the chips to get out.

I would call the attention of our younger mechanics to the fact that the twist drill is much better shaped than the straight fluted one to resist the twisting strain, and would recommend them to understand the why of it. The length of the spiral cutting edge of the twist drill is of course considerably greater than that of the Farmer lathe drill, or its equivalent, and would at first sight seem to be therefore more flexible than the other, but to unwind the twist would lengthen it, and this tendency to elongation is resisted by the tensile strength of the center of the drill.

I advocate a liberal use of twist drills. Besides a full set of standard sizes, I find it a great comfort to keep a set $\frac{1}{64}$″ smaller than each size in common use. These while drilling pretty good holes leave stock enough for a reamer, and after putting that through carefully you have a hole altogether lovely.

Our friend G. T. says that he grinds his drills carefully.

Now, I wouldn't say anything personal for the world, and not having seen his practice (though I ache to see it) I of course know nothing about it, and I can't possibly mean him. But I project it as a general, lamentable and incontrovertible truth, that to do a thing carefully is by no means, necessarily, to do it right. The successful things of the world are done with a certain ease and slam-bang that the word carefully is far from expressing. I know a fellow who tries a square upon eight sides of a tap and he can't tap a hole truly to save his neck. Another one I have in mind can't drill a hole in a piece of sheet-iron without trying a level upon it lengthwise, crosswise and cornerwise; yet if he were doing anything for which I felt in any way responsible, I would keep a sharp and constant eye upon him.

I suppose it must be a most trying thing for a sensitive individual to begin an unfamiliar job in a strange shop. I hope I am able to treat one in such a predicament with just and charitable consideration. But if you get into such a fix, don't be so putteringly painstaking as to show that you are utterly ignorant of the conditions of good workmanship. Nothing more readily betrays the poor workman than useless and unmeaning precaution. The man who is over-careful is, as to reliability, immeasurably below the one who is just careful enough.

The twist drill as an article of manufacture marks an important epoch in the history of the trade. If the production of the twist drill originated with a single individual, he is deserving of a monument. The twist drill was the first (or nearly the first) of the modern race of machine tools. From its advent the trade of the machinist has undergone a great transformation. The whole race of taps, dies, reamers, chucks, dogs, mandrels, &c., has followed the twist drill until the machinist has lost his independence and almost his identity. And with the tools have come in the long line of bolts, set-screws, studs, &c., and when I think of them I recall my suggestion of a monument to the wretch who opened the flood-gates to the tide of "Machinists' Supplies."

Steel Forging.

At a recent meeting of the Newcastle-on-Tyne Chemical Society, a paper was read on the "Variation in the Composition of Steel Forgings," which gave the results of a series of analyses made to ascertain if there was any difference in chemical composition between the central parts and the surrounding material of steel forgings. Samples of metal were taken from a forging of $7\frac{3}{4}$ inches in diameter, and formed from an ingot three tons in weight. These were submitted to analysis in the laboratory, great care being taken to obtain comparative results. The tests showed that impure metal was contained within a radius of one and one-half inches from the center. The general conclusion, from numerous other experiments, is that those parts of a steel forging corresponding to the part near the top and bottom ends of an ingot are homogeneous in their composition, and those parts of forging corresponding to the middle of the ingot contain a core of accumulation depending upon the size of ingot and the rate at which it cools.

At an auction sale of stocks, bonds, and other securities in New York City, May 2, 425 shares of the stock of the American Heating and Power Company (par value $100 a share) sold for $60 for the entire lot. This is the company that had so much trouble from the bursting of steam pipes in the streets last winter.

The Denver (Col.) Board of Trade is agitating the question of inducing parties to build blast furnaces and a rolling mill in that city. Iron ore and special advantages to mills and furnaces can be secured. The people of Denver are ready to assist such enterprises.

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NEW YORK, MAY 19, 1883.

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Industrial Exhibitions of 1883.

Judging from present appearances, industrial exhibitions are not only to occur in unusual number this year, but will be in greater favor than ever before. For some time, until within two or three years, such exhibitions have been losing ground in popular estimation, but the rapidity with which they are regaining it under common sense management and a better appreciation by the exhibitor of what is required to make them of practical utility, is an evidence of the favor in which they may be hereafter held.

In the past management of such exhibitions the distribution of medals and diplomas has been the prominent consideration—in fact, connected with the idea of making money apparently about the only one—while to the minds of too many exhibitors it was an opportunity to show phenomenally-finished products, adorned by exhibitions of the painter's art. Those who visited such exhibitions were actuated mainly by emotions of curiosity. Viewing machines and machinery of a quality that they could not expect to get on an order from the manufacturer was not satisfactory from any other view. About the only useful purpose the standard machinery exhibition of ten years ago served was to demonstrate what could be done in the way of manufacture, and not by any reasonable allowance what was being done. To the probable buyer of machinery those exhibitions possessed about the same interest as a picture gallery—pleasant places enough in which to satisfy one's curiosity. The curiosity part of the business has been quite overdone. As a matter of fact, amusement without instruction or benefit of some sort cannot be depended upon as sufficient attraction for busy men, and naturally enough those who furnish the amusement get tired of doing it without remuneration.

The modern idea of an industrial exhibition, the feature that is required to interest buyers, which is the chief aim of the exhibitor, is to show samples of what will be delivered on orders; to show the state of the arts as they are practiced, not as they may be practiced. If an industrial exhibition ever had a mission to perform in showing what could be done by an extravagant use of the trades' tools and appliances, that mission has been more than completed. The interest is now in what is being done as a matter of course, not as a matter of especial preparation and a bid for prize medals and exalted mention. These have ceased to interest the public, or even to tickle the fancy of exhibitors; in other words, they have been distributed so lavishly as to fail to convey any meaning.

Just in proportion as the buying public are impressed with the idea that exhibitors take this view of the case, and act accordingly, their interest in industrial exhibitions increases. To show a machine on which twice as much in the way of finish, material and workmanship has been expended as would be expended on one ordered from the manufactory; showing it with the tacit representation that it is a fair sample of the general product, strikes the would-be buyer as hardly honest, and is not in the end—unless the end is near by—to the advantage of the builder. One of the standard, and generally just, criticisms of American exhibits in foreign countries has been that there was too much "for this occasion only" about them.

More of actual construction, and less of show for the sake of show, is all that has been needed to make mechanics' fairs in this country an entire success. Exhibitors may have been a little slow to appreciate the fact that to be of any permanent value in the way of building up a reputation and establishing business, an exhibit should represent what they would duplicate on an order, but apparently the lesson is fairly learned. We believe that in the coming industrial exhibitions in various parts of the country, which, as intimated, are to be numerous, visitors will note a change in this respect more marked than in any year before. Upon this the managers of, and exhibitors at industrial fairs, are to be congratulated equally with those who visit such places for their advantage rather than for their amusement.

Cornell University Progress.

The students and graduates of Cornell University have lately been discussing the management of that institution. The students publish a small daily paper into which some criticisms of the methods of instruction recently found their way.

Nothing further of that nature will be published in the college paper, as a ukase has been issued to stop them. This, however, does not deter the alumni from freely reviewing the situation at the University.

A week or two ago they held a meeting in New York City and discussed what seemed to them causes of alleged decline in the number of students as well as prestige and usefulness of the institution. Considerable stress was laid upon the smallness of salaries paid to the professors. Although Cornell has an endowment of about $7,000,000, it seems that a very small part of the income is paid for instruction, while liberal outlays have been made for buildings and apparatus of almost bewildering variety. The results of such a policy should be looked for in fine architecture, heavily stocked laboratories and show cases rather than in the training of students. Instructors of energy and ability resign to accept positions where the compensation bears some reasonable relation to the results they are capable of accomplishing. It cannot be expected that they will remain for many years in what must be, to them, largely a labor of love, especially where resources are ample to suitably reward their efforts.

Cornell University is well equipped and endowed to instruct students in mechanical engineering. It is only six or eight years ago that its Department of Mechanic Arts was the most popular school of its kind in this country. It was mentioned everywhere in mechanical circles with admiration, and its graduates were early sought for to fill responsible positions. One alumnus of that period is now drawing the comfortable salary of $12,000 a year as superintendent of a large iron works on the Pacific Coast, and we know of several others who are employed in leading machinery establishments, not merely carrying out the ideas of others, but originating some of the best productions of those establishments. Since then a change has been wrought. If now it should be gravely asserted in well informed mechanical circles that Cornell engineering department is a superior mechanical school the person making the assertion would subject himself to ridicule.

We know very little of the University management, but are in position to know something of its results in the mechanical line. Evidently there is something about it decidedly open to improvement.

Facts About Engravings.

One of our English mechanical contemporaries issues a supplement with a red line border, exhibiting specimens of wood engraving. Some of the best are designated as "engraved by machinery in the American style." While this is a compliment to the character of engravings made on this side of the Atlantic, there is some doubt about what may be regarded as "the American style." We have all styles and qualities of wood engraving and process engraving represented in illustrated newspapers, magazines, and trade circulars and catalogues. They may average better in quality and style than those of English origin, but it is nevertheless a fact that engravings of real excellence, especially of machinery, are decidedly in a minority. The principal reason for this is the unwillingness of so many machinery manufacturers to pay the price the best engravers are able to command.

It is frequently the case that some inferior engraver is found who promises a "first-class" job at a second or third class price. The result is almost always unsatisfactory. A poor engraving misrepresents a good machine and is a damage to the manufacturer. It is frequently inferred from the examination of a poor engraving of a machine or tool that the manufacturer is no more particular about the fitting and finishing of his productions than about the style of their representation upon paper. Sometimes, it is true, he is deceived by the engraver; but then some one may ask: Is he not likely to be deceived by the machine fitter, also?

We have had some experience with different kinds of engravings during the last six years, but have never discovered any good substitute for wood engraving for making perspective or shaded views of machines. In our estimation, for outline or skeleton cuts, with but little shading, the wax process is superior to any other kind of engraving. The cuts of that character in our columns are all made by the wax process. The best maps are engraved by this process. For certain purposes photo-engraving (in addition to being cheap) is admirable, but our experience with several different kinds of photo-engraving for the AMERICAN MACHINIST has in every case been unsatisfactory. Where ragged lines and blurred figures and letters can be endured in mechanical details photo-engraving will save expense (for good cuts are not very low priced); but our readers, being accustomed to clearness of line and letter in engravings, would not be satisfied with ratty illustrations.

Several electrotypes should be made from each wood engraving, so that if one of them is lost or in use another is ready to print from at any time. Electrotypes are comparatively inexpensive, but we have known parties to spend ten dollars' worth of time in searching for a fifty cent electrotype because they had obtained but one at first, not thinking about future requirements.

The new catalogue of the American Society of Mechanical Engineers gives names and addresses of its 365 members. They represent 26 States and 2 territories, also England, France, Germany and China. We are informed by the Secretary, Frederic R. Hutton, 15 Cortlandt street, New York, that about 40 applications for membership are to be acted upon at the meeting in Cleveland, O., June 12th. The Society was organized April 7, 1880, and incorporated Dec. 27th, 1881. An effort is being made to have several ten minute papers read at Cleveland, on practical mechanical subjects, without entering into the higher mathematics. We commend the plan to the attention and co-operation of every member who can attend that meeting

From all that we can learn the tendency in the machinery trade seems to be towards improvement. Six or eight weeks ago the outlook was dull. Orders, upon the whole, are given more freely, and while large failures have occurred in other branches of trade nothing startling has transpired in the way of financial difficulty in the machinery trade nor is anything of the kind expected.

While the question of increasing the water supply of New York City lingers between conflicting "interests" and "jobs," it would be interesting to know what the insufficiency of the supply is costing the inhabitants. If the management of a private enterprise took the time to consider important measures that come before it that the average city authorities will consume in deciding upon the question of water supply, the business would generally come to grief. In the majority of instances it could be demonstrated without much difficulty that when it comes to a consideration of increasing the water supply of a city to meet absolute demands, the necessary changes are paid for three or four times over; first in the loss occasioned by the lack of an adequate supply, and finally in constructing the necessary works. Undoubtedly it is wise to weigh such matters carefully, but that it should take a city four or five years to *begin* to meet a positive emergency is anything but business. Water, one of the commonest of things, seems the hardest to obtain.

Just how much can be told of the qualities of iron and steel, so far as these qualities affect their usefulness in the industrial arts, is a matter of considerable importance, and

one upon which some light may be thrown by the expert testimony to be taken in a lawsuit commenced by a citizen of Sweden against the Albany & Rensselaer Iron and Steel Company. The suit is to recover damages for the refusal of this company to accept a quantity of Swedish pig iron, the grounds for the refusal being that the quality of the iron is not as represented. Whether and to what extent the experts whose testimony it is expected will be introduced by both parties to the controversy will agree, will be chiefly important as indicating to what extent dependence can be placed upon their conclusions generally.

The steam engine has for years been held up as an awful example of waste of energy, utilizing as it does but about $\frac{1}{10}$ of the heat of the fuel used in generating steam. As an evidence to what extent this loss is exceeded in other ways, it may be noted that in a paper recently read before the Academy of Sciences, at Washington, by Professor Langley, he demonstrated that in the Argand burner only 24 parts of energy out of 1,000 are utilized as light—a loss about four times greater than in the steam engine.

Any subscriber who can furnish all the issues of the AMERICAN MACHINIST comprised in volumes 1 and 2, and is willing to dispose of same, may find a customer by addressing Messrs. Trübner & Co., 57 and 59 Ludgate Hill, London, England, who desire to purchase a file of the same for the Great Seal Patent Office.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(179) A. F., St. Paul, Minn., asks: Will you tell me the process of making a wiped joint on pipes? *A.*—See answer to question 379, in issue of November 4, 1882.

(180) J. S. L., Philadelphia, Pa., asks: What kind of gas is used in a balloon, and what is its sustaining power per cubic foot? *A.*—Hydrogen gas; sustaining power, about .07 lbs. per cubic foot.

(181) E. H. K., Bath, Maine, asks: 1. How is phosphor-bronze made? *A.*—By adding a small percentage of phosphorus—exactly what per cent. we cannot say—to ordinary bronze alloys. 2. What is the best form of propeller wheel for small river boats, a three or four bladed one? *A.*—Opinions are about evenly divided on this.

(182) C. S., Worcester, Mass., asks: Can you tell me of a dip for small iron castings? *A.*—Small iron castings may be bronzed as follows: Clean by immersing in sulphuric acid and water, then scouring with sand, and finally washing in clean water. To bronze, dip in a solution of sulphate of copper; afterwards wash in water.

(183) H. W. S., Gouverneur, N. Y., asks: 1. Will you give me a description of the lathe in which the fly-wheel of the engines of the Mile End Thread Mill was turned? *A.*—The wheel was turned in a vertical boring and turning mill, made by the same firm that built the engines. 2. Have you the number of the AMERICAN MACHINIST in in which the Westinghouse engine was illustrated? *A.*—Yes. The date of the number is September 16, 1882.

(184) W. G., Kentville, Nova Scotia, writes: We want to run a 15-horse power engine 500 feet distant from boiler, in addition to our present 20-horse power engine. Can steam be successfully carried that distance, and, if so, what size steam pipe should be used, and what pressure steam; also, what size boiler would be required for both engines? *A.*—Steam can be carried that distance without material trouble, but the pipe should be thoroughly covered and protected. We should say use a 4″ pipe. Carry pressure sufficient for the work. If cut-off engines are used, say from 70 to 80 lbs.; boiler, 15 to 18 feet heating surface per horse power.

(185) Ignoramus, Springfield, Mass, asks: 1. In speaking of the point of cut-off in a steam engine, from what is it customary to reckon? *A.*—The distance the piston has traveled when steam is cut off from the cylinder. Cut off at 6″ means that the piston has traveled 6″ when the admission valve closes. 2. Steam or water does not enter the common steam gauge. What, then, moves the pointer? *A.*—On the contrary, steam or water does enter the common steam-gauge, and its pressure against or in a spring operates to move the pointer. 3. Does the size of the combustion chamber under a horizontal boiler make any difference with the burning of the fire? *A.*—It makes no material difference with the burning of the fire in the furnace. Where the gases that escape over the bridge wall are, by special means, ignited in a combustion chamber, its dimensions will have something to do with the result. 4. Will a common double-acting belt pump run down, with the valves and plunger tight, if the stuffing-box leaks? *A.*—If the valves are quite tight, the pump will not "run down."

(186) J. R., Detroit, Mich., asks: 1. Can as much water be evaporated, from the temperature of the feed, at 100 lbs. pressure as at 50 lbs.? *A.*—No. 2. What is meant by the density of steam, and what is the density of steam at 100 lbs. pressure? *A.*—By the density of steam is meant the weight of a unit of volume, as a cubic foot or inch, compared with the weight of water. The density of steam at 100 lbs. (gauge pressure) is given as .00386 by some authors; by others a little different. 4. Is there any air in water, and could a person open his eyes 50 feet under water? *A.*—There is air in water. We see no reason to doubt the ability of a person to open his eyes under the circumstances mentioned. 5. Can a boiler foam in some part, and not all through it? *A.*—The cause of foaming may be in some part of the boiler, but the influence will be felt all through the water. 6. What proportion of air is mixed with gas, as used in a gas engine? *A.*—From ten to twelve parts of air to one of gas. 7. Why is the connecting rod of a steam engine not of the same diameter as the piston rod, when both are submitted to the same strain? *A.*—The strains on a connecting rod are somewhat different from those on the piston rod. It was an old custom to make the necks of connecting rods the same diameter as the piston rod, but in present practice they are usually, and properly, made larger. 8. Why is the right-hand crank of a locomotive always made the leading crank? *A.*—Because it is advisable, and to an extent essential, to have uniformity in this respect. 9. Is it necessary to open the steam valve of all injectors before opening the water valve? *A.*—No.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Shafting Straighteners—J. H. Wells, Tampa, Fla.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

James W. See, Consulting Engineer, Hamilton, O.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

In stock.—16″ speed lathes of superior design, from new patterns. Fay & Scott, Dexter, Me.

Franck D. Johns, attorney at law and solicitor of patents, 617 Seventh St., Washington, D. C.

A. Wilkinson, expert steam engineer, Manayunk, Philadelphia, Pa.

Consulting Engineer and Mechanical expert, C. C. Hill, 144 LaSalle street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

For sale, 25″ lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 42,) New York City.

H. E. Penney, manufacturer of Steel Spring Cushioned Helve Hammers. Photo and circular on application. Minneapolis, Minn.

New tool chest, price $10. See description in AM. MACHINIST, April 14th, or send for circular. Goodnow & Wightman, 176 Wash'ton st, Boston, Mass.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Boiler Scale.—Parties having fine specimens for sale or loan, for exhibition, address Jas. F. Hotchkiss, 84 John street, New York.

Speed and drill lathes, 10″x4′, new design. Self-clamping rest, first-class material and work. Parties about to buy will do well to inquire. C. Wing, Greenfield, Mass.

The Complete Practical Machinist, $2.50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4.00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton street, New York.

Free—"Useful Hints on Steam." A book of 96 pages, illustrated. Valuable to engineers, steam users and those about purchasing steam machinery. By mail, 15 cents, or free on personal application. E. E. Roberts, 107 Liberty St., New York City.

Cheapest, strongest, most simple, compact, durable, effective and economical steam pump in the market, for raising liquids under and up to 100 feet. No machinery, no oil, no special care. Can be worked suspended by a chain. Pulsometer Steam Pump Co., 83 John street, New York.

We will pay 25c. each for copies, in good condition, of the issues of January 1st and January 8th, 1881. Those sending us either of the above dates will kindly write their name and address on the wrapper for identification. AM. MACHINIST Publishing Company, 96 Fulton street. N. Y. City.

Wanted—Correspondence with engine builders, boiler makers, and supply dealers in steam goods. We manufacture the *cheapest* Injectors and best Steam Jet Pumps in this country, and offer to *live men* the most liberal terms ever named. Drop postal for particulars to J. B. Sheriff, Son & Co., 68 Water St., Pittsburg, Pa.

"Useful Information for Steam Users"—a 100-page illustrated pamphlet, carefully compiled from the best authorities, on the care and management of the steam engine and boiler, with hints for engineers and firemen. Engineers everywhere should have this work. Send 25 cents in P. O. stamps for a copy. The J. N. Mills Publishing Co., 145 Broadway, New York.

Now ready for delivery, volume 5 of the AMERICAN MACHINIST, comprising the year 1882, (52 issues) complete with index, in substantial book form. Also a few remaining of volumes 3 and 4 comprising the years 1880 and 1881, can be sent anywhere by express. Price of each volume, $4.00; express charges to follow. AMERICAN MACHINIST Publishing Company, 96 Fulton street, New York City.

For a strictly first-class automatic engine, from 10 to 60 horse-power apply to the Straight Line Engine Company, Syracuse, N. Y.; medium or high-speed; perfect balance; fewest parts and fewest working joints; uniform speed at all ranges of power or steam pressure; the best material and workmanship in all vital parts; the most correct distribution of iron; unexcelled in smooth running.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

MANUFACTURES.

Southington, Conn., is to have a $30,000 match company, a $100,000 stockinet company, besides a silver company.

The Western Electric Company are building a four-story factory in Chicago, on South Clinton street, to cost $80,000.

The Link Belt Machinery Co., Chicago, Ill., are building a 28-foot straightening and turning lathe for their own use.

The Anniston Manufacturing Company, Anniston, Ala., are resetting four tubular boilers with the Jarvis furnace, and will use the Alabama slack coal for fuel.

Mount Pleasant is considering the propriety of adopting the Holly system of water works. It will cost $110,000 to put the system in good shape.—*Iowa Tribune.*

Franke & Schindler, Indianapolis, Ind., heavy dealers in cabinet hardware, are now putting in a full line of machinists' tools. They are agents for the National chuck.

The National Manufacturing Co., New Haven, Conn., report a steady increase of sales of their chuck to the better class of manufacturers. J. A. Fay & Co, of Chicago, are sales agents.

J. H. Wells has sold the machine works at Vineland, N. J, to John Gage, and proposes to build a shop at Tampa, Fla., for the manufacture of shafting straighteners and for jobbing.

The Boston *Commercial Bulletin* says: "All the manufacturing establishments in Wallingford, Conn., are busy and extending their business and increasing the number of their workmen."

An English company has purchased 90,000 acres of iron land in East Tennessee. They supply a capital of one million dollars, and will erect furnaces at once, giving employment to three hundred men.

The already extensive machinery works of Geo. Felber are being considerably enlarged by the erection of an additional brick building, 100 feet long and 24 feet wide, fronting on Third street.—*St. Louis Age of Steel.*

About 40 car-loads of dismounted locomotives passed over the New Haven Railroad recently, to be shipped from Boston to the Government of Victoria, N. S. W. They were from the Baldwin Locomotive Works, Philadelphia.

The Oregon Iron and Steel Company, recently incorporated, is to erect mills at Portland, Oregon. Capital stock, $3,000,000. The plant has been purchased, and it is expected that the mills, furnaces, etc., will give employment to 2,000 men.

At Worcester, Mass., Mr. Batchelder has nearly completed the foundations for a new shop, 180x58 feet, on Gold street, for Mr. Fred E. Reed, manufacturer of machinists' tools. The shop is to be two stories high, and some 400,000 bricks will be used in its construction.

The Port Royal Fertilizing Company, Port Royal, S. C., are setting two tubular boilers with the Jarvis furnace, and will use fine coal for fuel. The agency for the Jarvis Furnace Company in this vicinity is managed by Messrs. F. Brotherhood & Co., No. 165 Meeting St, Charleston, S. C.

The Hartford Tool Company is the name of a new corporation organized to manufacture the Woodbridge lathe and planer tool, heretofore manufactured by Pratt & Candee, of Hartford, Conn. Other small tools will be added from time to time. The lathe and planer tool above named has been on the market only a short time, but has had an extraordinary sale.

The National Machinery Co., that lately moved from Cleveland to Tiffin, Ohio, say they are getting nicely located in their new shop, which is 100x300 feet, all in one room. They have their foundry nearly completed, 80x120 feet, and will start their 80-horse engine in a few days.

At a meeting of the Lynchburg, Va., Chamber of Commerce, in regard to soliciting subscriptions to establish a woolen mill at that city, it was stated that $150,000 could be easily raised, and it was determined to enter into correspondence at once with the proper parties for the establishment of this mill.

Fifty tons of one brand of horse-shoe nails have been exported during the last two months to Great Britain by L. P. Rose, 5 Dey street, New York. Such has been the growing demand in England and Ireland for American horse-shoe nails, that the British purchasers of the above recently sent a master mechanic to this country to arrange for purchasing a full set of the machinery used in producing them.

"Description of the Porter-Allen Steam Engine, as made by the Southwark Foundry and Machine Co., Philadelphia," is the title of a 54-page pamphlet, written by Charles T. Porter. It gives a full and intelligible description of the engine, and plain directions for engineers to run it. The illustrations are many in number and first-rate in execution. "The Advantages of High Speed" are treated at some length. The book contains much information useful to engineers.

It is said that there is no immediate prospect of the North Chicago rolling mills resuming operations. About 2,000 men were thrown out of employment by the stoppage of these mills, and about 1,800 by the stoppage of those on the South Side. Mr. O. W. Potter, president of the mills, thinks that one-third of the required rail supply for this year is in the market already, although this, of course, is mere estimate, and says that his company will produce about 175,000 tons of pig metal this year. The price of ore has declined 20 per cent., but the price of labor has also declined.—*Railway Age.*

The Lackawanna Iron and Coal Co., of Scranton, Pa., have an improved rail-mill plant invented by W. K. Seaman, one of the company's draughtsmen. From the time the rail leaves the rolls it is carried along between a series of grip-wheels, which guide it to the saws, and at the same time take out any bends or kinks that may have been caused by unequal heating of the metal. Next the rail goes through a vertical straightening machine, and then through a cambering arrangement to the hot-bed, where it is placed in position for cooling. The whole plant is controlled by a couple of men, being almost automatic in its operations.

The following from the Pond Engineering Co., St. Louis, Mo., came too late for last week's issue: "We shall on May 1st increase our business, by occupying 707 Market St., formerly occupied by Henry R. Worthington, together with 709, our present store. We propose to remove the partition between them, which will give us the finest salesrooms for machinery in St. Louis. We shall open in the new store with the largest line of pumping machinery, both single and duplex, manufactured by the Geo. F. Blake Manufacturing Co., ever exhibited in the West; so that an order for a pump, from the smallest boiler feed to a water works engine, can be filled at short notice.

The Yale Lock Manufacturing Company, Stamford, Conn, have just completed the erection of a 15-ton power traveling crane, with a span of 71 feet, for Messrs. Mackintosh, Hemphill & Co., Pittsburg, Penn.; a 20-ton crane, with a span of 56 feet, for the Scranton Steel Company, of Scranton, Penn.; and are now erecting two 25-ton traveling cranes, with a span of 59 feet, for the Norfolk and Western Railroad. They are now running their works with two gangs of men, night and day, and have under way, among other cranes, two 22½-ton cranes, with a span of about 60 feet, for the Chicago and Altou Railway shops at Bloomington, Ill. The peculiarity of these latter cranes is that each crane has two separate trolleys, so that the two cranes combined can lift a locomotive, taking hold at four points.—*Stamford Advocate.*

J. Elliott Shaw, 154 South Fourth St., Philadelphia, Pa., is introducing the Burgess' mechanical blow-pipe with considerable success. The device consists of a cylinder, in which a piston is worked by a treadle motion. Over the cylinder is an air reservoir, that provides for a constant pressure of air, which may be kept at any pressure desired by varying the motion of the treadle. Near the top of the reservoir is a nipple, to which the rubber hose of the blow-pipe is attached. The hole in the end of the blow-pipe is much smaller than in the ordinary mouth blow-pipe, as it is found that better results are obtained by this construction. The apparatus is mounted upon a stand, and only weighs a few pounds. For light work a very easy motion of the treadle is required, but for work of considerable size a few quick strokes of the treadle increases the pressure in the reservoir to 10 or 12 lbs., when an easy motion will maintain it, giving an intense heat. When gas is used a stand and burner is furnished, but alcohol or oil flame may be used. This device is used not only by dentists, jewelers, assayers, chemists, etc, but is very convenient for machinists, in tempering small tools or in annealing small pieces of metal, and in brazing and soldering, or, in fact, for any purpose where a strong local heat is required. It may also be used for creating draft in small melting furnaces, and for a great variety of purposes that will suggest themselves.

Machinists' and Engineers' Supplies.

NEW YORK, May 3, 1883.

The general condition of the supply market is satisfactory and orders continue to increase somewhat. Prices are firm and the outlook good.

Iron and Metal Review.

Although more business has been transacted during the past week, owing to the reduction in the prices of Pig Iron, yet the general tone of the market is weak. Some of the buyers predict lower prices, hence they are cautious in making purchases. The labor question creates additional apprehension of the situation. We quote: Foundry, No. 1, at $22; Foundry, No. 2 X, $20; and Grey Forge, $19.50 to $20.50. The condition of the Foreign Iron Market remains unchanged, and no fresh business has been transacted since our last report. The demand for Merchant Bar is light. Scrap is also dull, with prices unchanged. Copper is dull at 15⅞c. for Lake Superior, other brands 14¾c. to 15⅛c. Banca Tin, 22c. Straits and Malacca, 21¾c. to 21⅞c. Billiton and Australian, 21⅛c. to 21⅝c. English Lamb and Flag, 21⅞c. to 22c. English Refined, 21¾c, to21⅞. Spelter Common Domestic, 4.75c. to 5c. Silesian, 5⅛c. to 5¼c. Refined, 8c. to 8¾c. Antimony, 9¾c. to 9⅞c. for Hallett's, and 10¾c. to 10⅞c. for Cookson's.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—A good draughtsman on machine tools. State experience and references. Address, W. P., AM. MACHINIST office.

Wanted—Situation as foreman and draughtsman in pattern shop. Marine preferred. Address, Pattern, care AM. MACHINIST.

Wanted—Ten first-class machinists, to work on wood-working machinery. Address, Box 3, AM. MACHINIST.

Wanted—A situation by a mechanical engineer, first-class draughtsman and machinist. Can speak French, German and English. Address, Th. V., Smithville, Burlington Co., N. J.

Wanted—Lathe hands. Several strictly No. 1 lathe hands, first-class men, can earn good wages and have steady job. Apply to Niles Tool Works, Hamilton, O.

Wanted—Ten machinists familiar with work on mowers and reapers; good wages and steady work for the right sort of men. Address "Mower and Reaper," care of AM. MACHINIST.

Wanted—A first-class machinist, tool and die maker would like a situation with some reliable firm. The best of reference furnished. Address, Tool Maker, office AM MACHINIST.

Wanted—Foremanship of factory or machine shop. Eight years' experience in first-class shops as foreman and supt.; very best of reference. Address, Successful, AM. MACHINIST, 96 Fulton street.

Wanted—For a large, well-equipped machine works, a thoroughly competent man to fill the position of master mechanic or general foreman. Address, B., AM. MACHINIST, giving full name and address.

A graduate of a German polytechnic school, four years' practical experience in machine shops abroad, desires a situation as draughtsman or engineer with a large manufacturing concern. Best of references. Address, N., BOX 4, AM. MACHINIST.

A graduate in mechanical engineering desires a position. Able to compute strains. Up in resistance of materials, link and valve motion (Auchincloss). A good draughtsman, with some years' practical shop experience. Thoroughly conversant with transit and level. Address, M. E., AMERICAN MACHINIST.

Wanted—By a large machine shop, whose specialty is pumping machinery, a thoroughly competent foreman, who can produce the best work at the least cost. An intimate knowledge of the best machine shop practice and the energy to execute it is of the first importance. Address, with references, and stating qualifications, Machine Shop Foreman, care AM. MACHINIST.

Wanted—A mechanical manager for a manufactory in Chicago, employing between 300 and 400 hands, and comprising a machine shop, a blacksmith shop, an iron foundry, a pattern shop, a millwright shop and a cabinet shop. Any applicant must be strong, reliable, and not above forty years of age. He must be thoroughly accustomed to steam-engine work, and to all of the details of economical shop management, and he must be a wide-awake man. One with some knowledge of business preferred. This is the best sort of an opportunity for the right man. Address, giving particulars, C. C., AM. MACHINIST.

Light and fine interchangeable machinery to order. Foot and power lathes; slide rests, &c. Catalogue for stamp. Edwd O. Chase, Newark, N. J.

BOOKS —RELATING TO— Steam Engines, Machinery, Heat, Gas, Electricity, Casting and Founding, &c.

DESCRIPTIVE CATALOGUE, 100 PAGES, 1883, SENT FREE ON APPLICATION.

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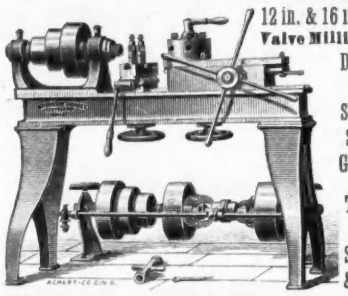
BRASS WORKING MACHINERY.



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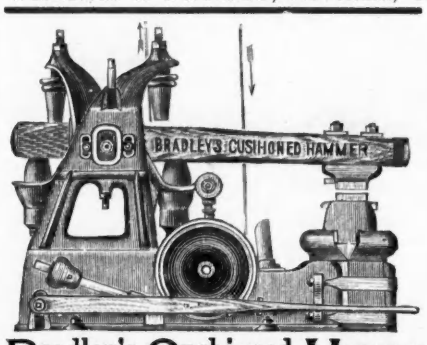

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Stands to-day WITHOUT AN EQUAL.

OVER 700 IN USE.

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COOKE & CO., DEALER IN

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AGENTS FOR THE

Greenfield Vertical Engines

2½ to 30 Horse Power.

Unequaled in workmanship and quality of material. Prices lower than any other first-class engine.

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JOSIAH MACY'S SONS,

189 & 191 Front Street, New York,

MANUFACTURERS OF

LUBRICATING OILS,

Lard, Sperm, Whale and the

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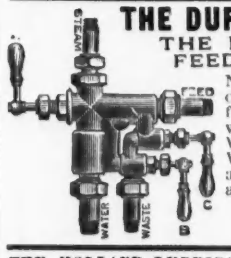
Brands of all gravities, suitable for all grades of work; light, heavy, slow and high speed.

Samples Submitted Free. ESTABLISHED 1822.

THE DUPLEX INJECTOR,

THE BEST BOILER FEEDER KNOWN.



Not liable to get out of order. Will lift water 22 feet. Always delivers water *hot* to the boiler Will start when it is hot Will feed water through a heater. Manufactured and for sale by

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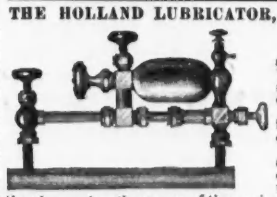
THE HOLLAND LUBRICATOR, VISIBLE DROP,



Is guaranteed to be 1. A perfect insurance against the cuttting of Valve-seats, Cylinder and Governor Valves of the engine. 2. It will pay for itself in 6 months' in saving of oil, coal, and packing 3. It will insure more speed ... the revolutions of the engine, say from 1 to 2 strokes per minute, thus increasing the power of the engine. Manufactured by

HOLLAND & THOMPSON, 217 River St., Troy, N. Y.

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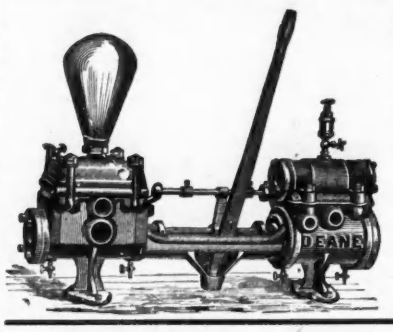
GEO. F. BLAKE MANUF'G CO.

HAVE REMOVED TO THEIR NEW QUARTERS,

95 & 97 LIBERTY STREET, N. Y.



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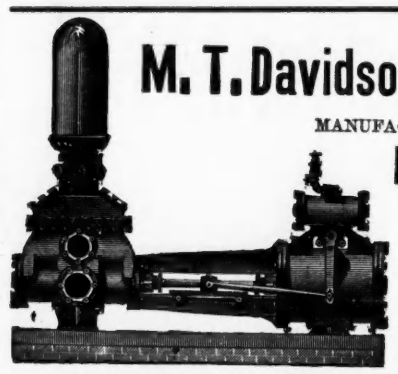

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Warranted the Best Pump made for all Situations.

KELLY & LUDWIG, Agents,

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One Iron Planer. Planes 42 inches x 12 feet. Built by New York Steam Engine Co., 1873.

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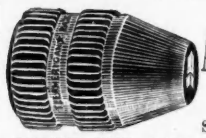
JOSEPH B. MATTHEWS,

AUTOMATIC ENGINES, BALTIMORE, MARYLAND.



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American Drill Chuck

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THE HERCULES TURBINE

Gives more power for the same size, also better average results from full to one-half gate than any other water wheel ever made. It is moderate in cost, compact in form, and not liable to get out of order.

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SHOPS AT

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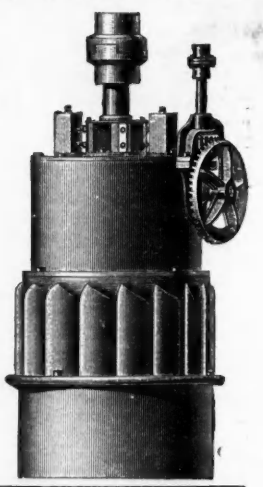
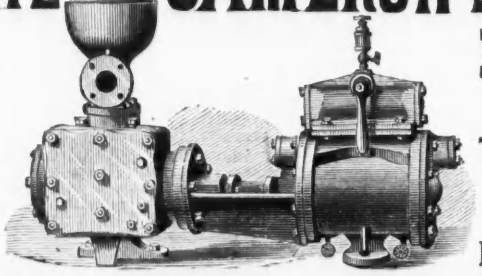
Send for Catalogue, Circulars and Price List to either of the above places.



THE CAMERON STEAM PUMP.



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THE A. S. CAMERON Steam Pump Works,

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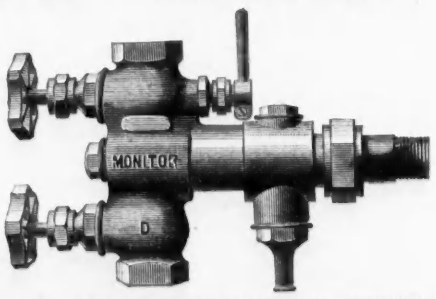

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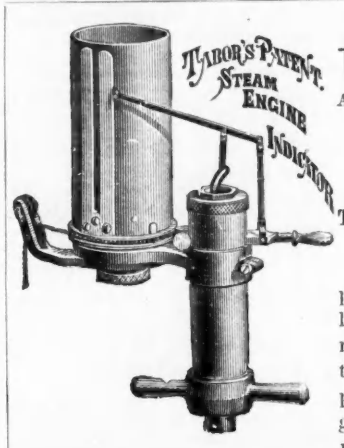

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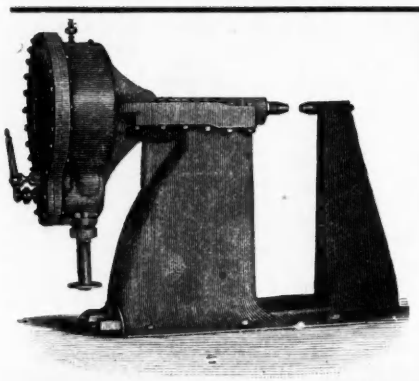

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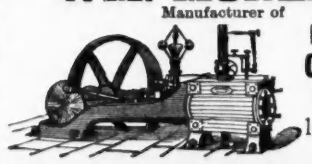

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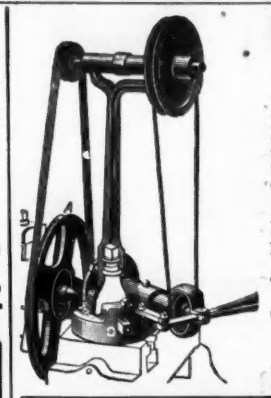

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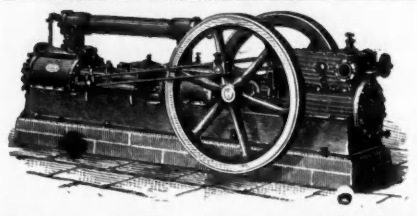

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" 7	1 1-8 "		.95
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" 10	1 1-2 "		1.10
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Full set, 19 Dogs,			26.35
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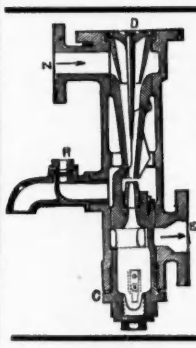

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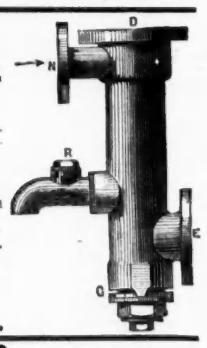

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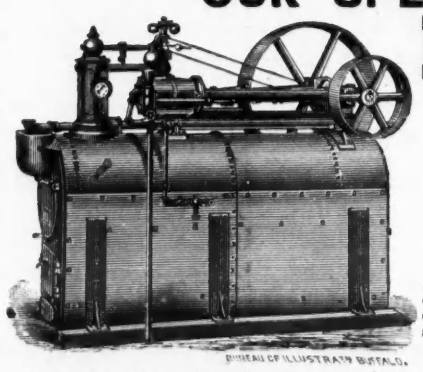

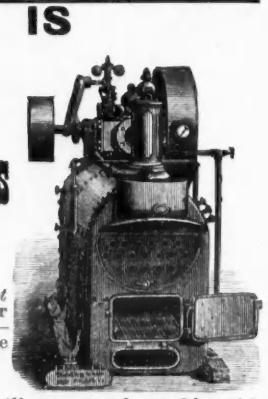

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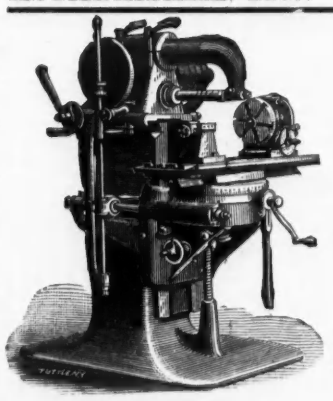

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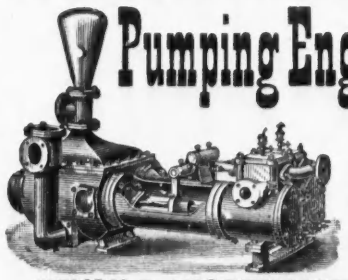

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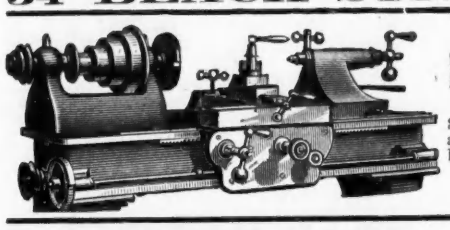

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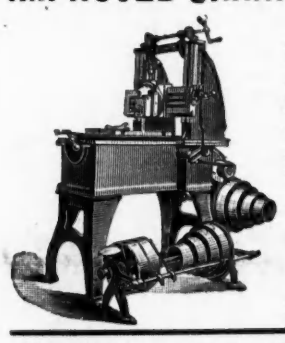

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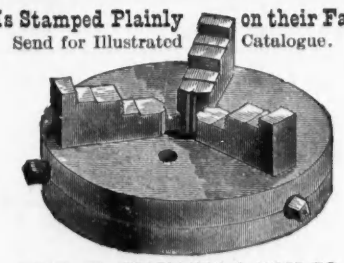

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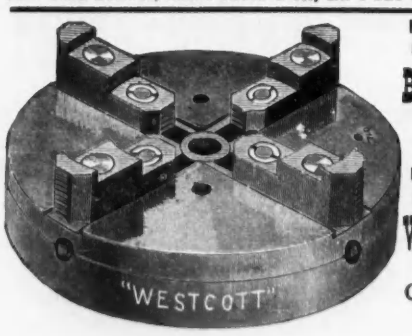

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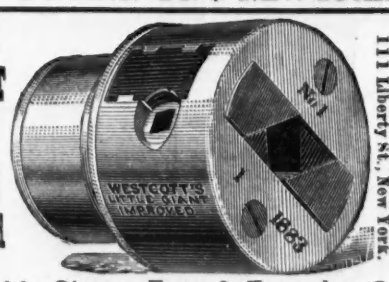

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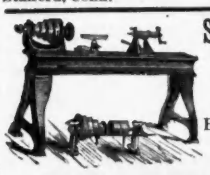

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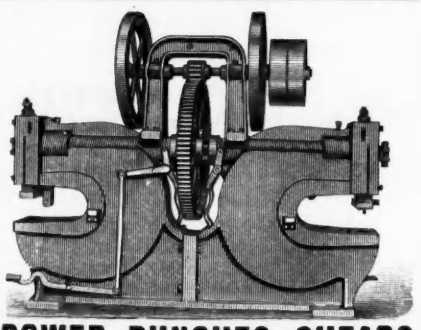

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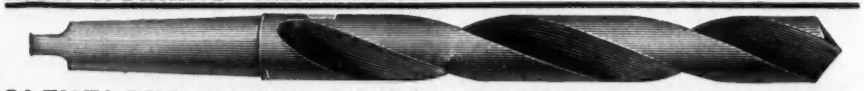

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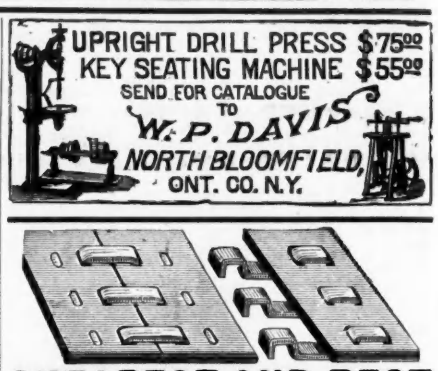

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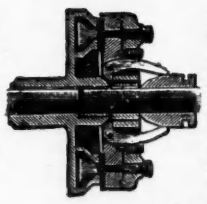

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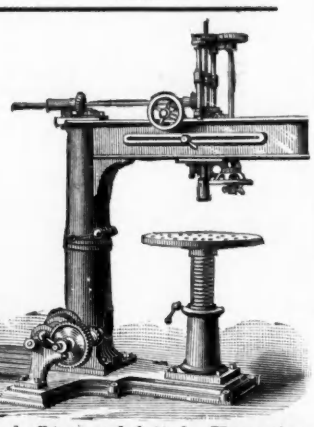

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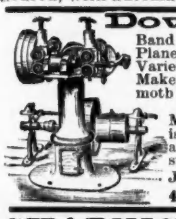

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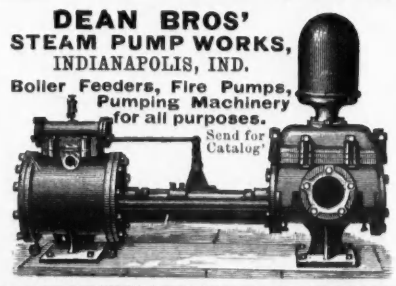

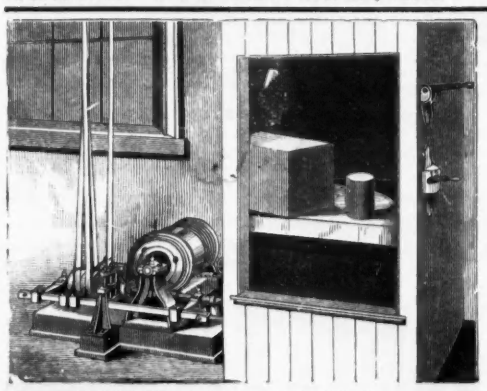

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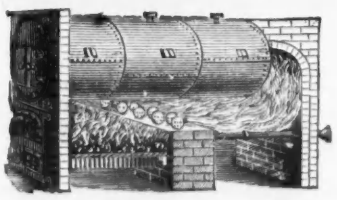

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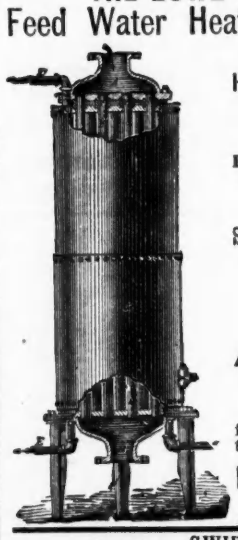

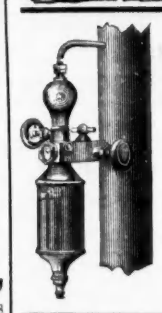

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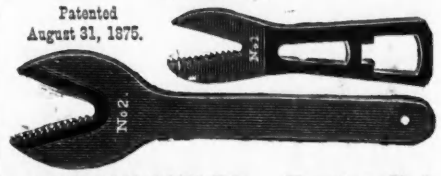

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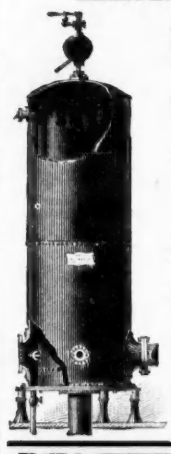

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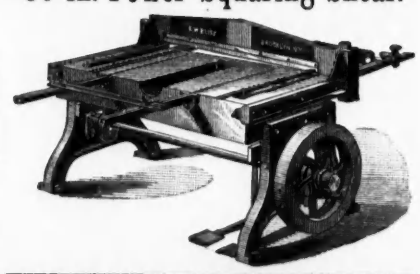

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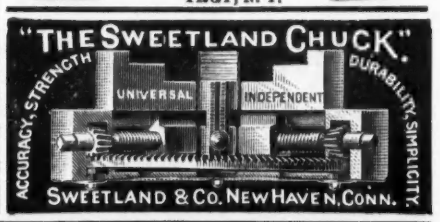

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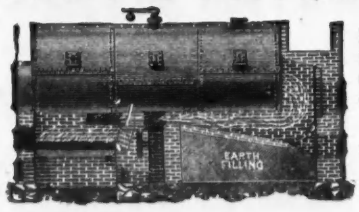

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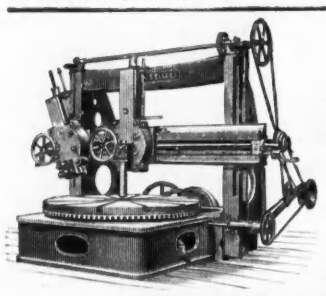

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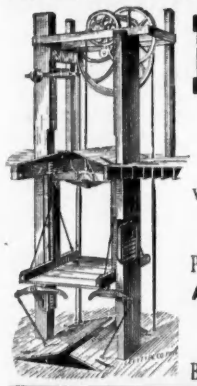

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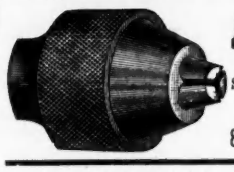

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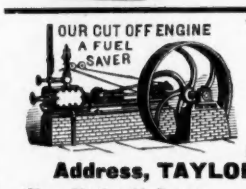

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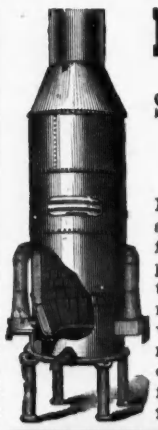

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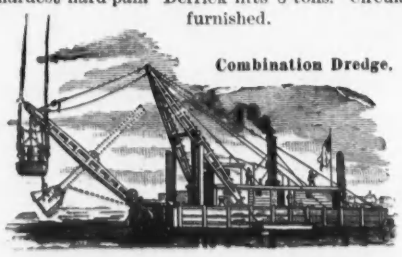

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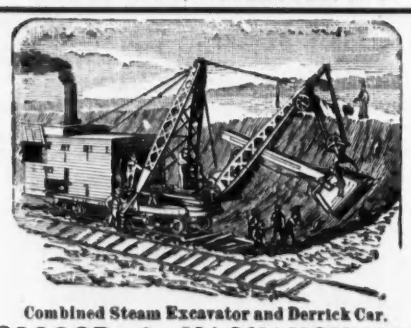

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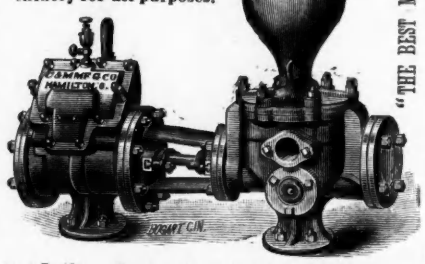

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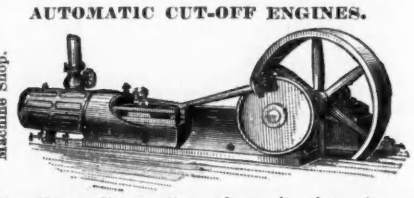

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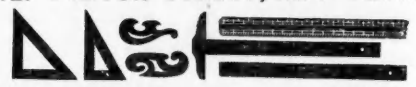

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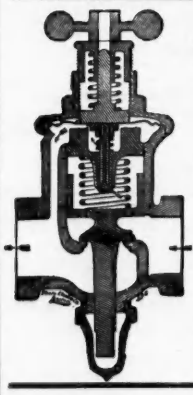

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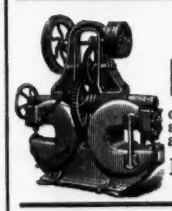

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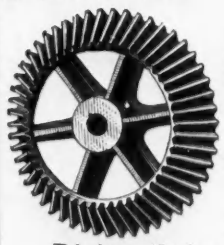

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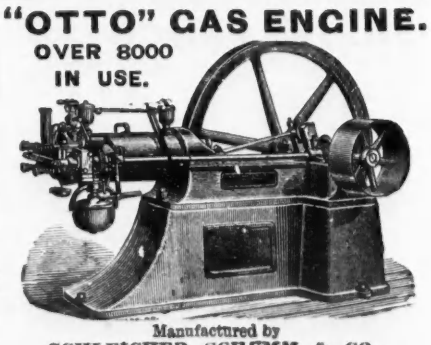

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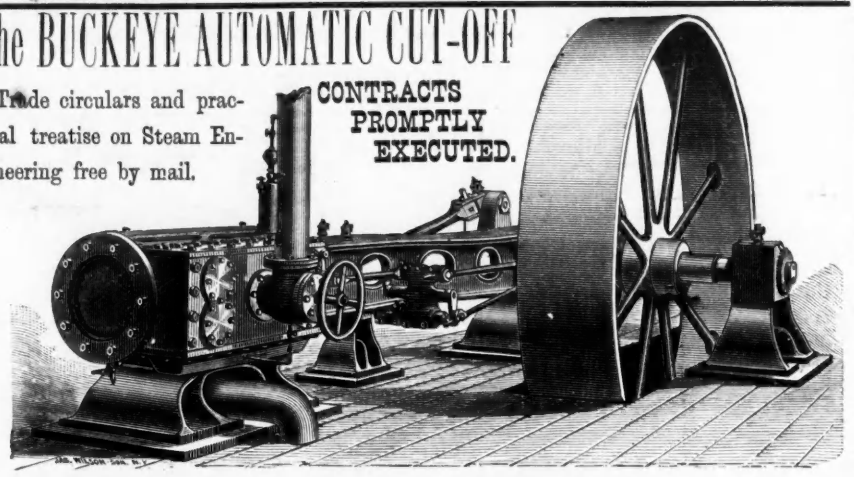

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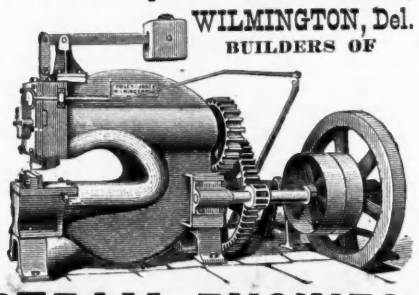

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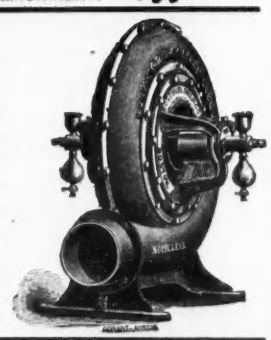

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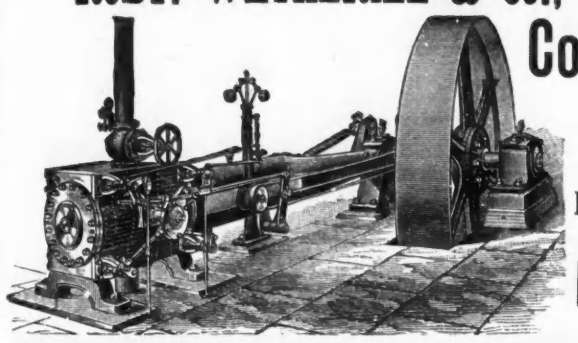

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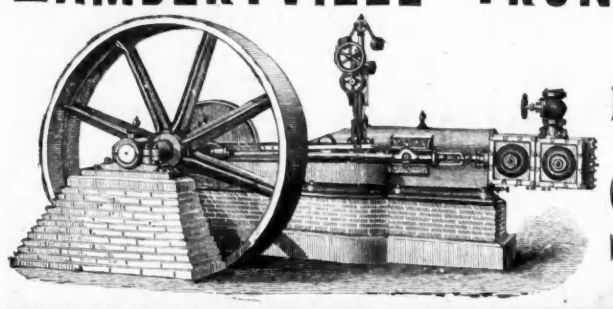

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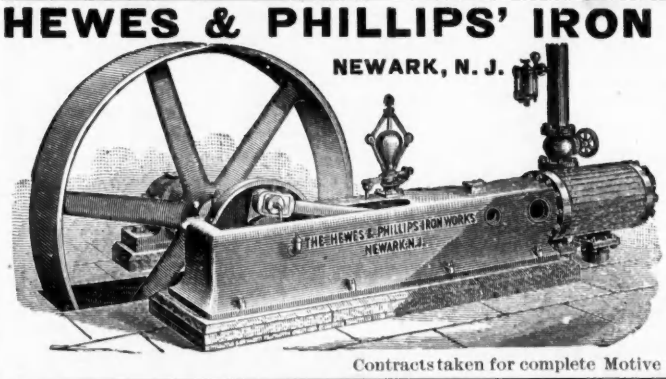

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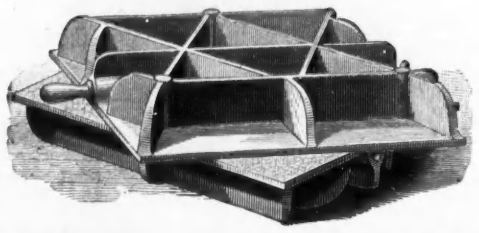

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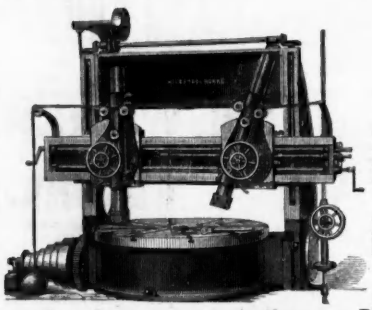

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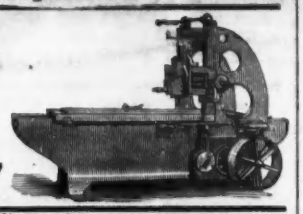

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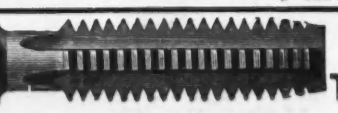

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